CONTRACT NO. NAS5-1272

PROJECT RELAY

QUALITY CONTROL PROCEDURES AND FLOW CHARTS

Prepared for the

NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION
WASHINGTON, D. C.

By the

RELAY PROJECT OFFICE
DEFENSE ELECTRONIC PRODUCTS

RADIO CORPORATION OF AMERICA

PRINCETON, NEW JERSEY

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SECTION I

PURPOSE AND FUNCTION OF THE PROGRAM

A. INTRODUCTION

The quality control program has set forth the system and procedures for handling all materials during the manufacturing process. The quality control office was assigned the responsibility of supplying information and guidance to the manufacturing activities in order to assure a quality product. The direction of the quality control program ensures that inspection and quality control procedures are conducted in such a manner as to satisfy the quality control requirements of the Project Relay contract.

B. IMPLEMENTATION OF PROGRAM

In order to have an effective quality control program, several tags, forms, procedures, and flow charts have been developed and implemented. The tags and forms (refer to Section II) provide the records and documentation necessary to assure that the quality control program is adequate for the production facility. Continuous analysis and evaluation of these records provides the follow-up information on the quality control program and the manufacturing process. The procedures and flow charts for each manufacturing process (refer to Section III) illustrate the inspection check points required by the production and quality control inspectors.

The quality control program provides for a roving quality control monitor. His duty is to make the manufacturing and engineering activities aware of the extent of the program. The quality control monitor is also in a position to locate difficulties in the manufacturing process which could cause a degradation of the product. Where difficulties which could affect the product quality become evident in the manufacturing process, the quality control monitor will lend assistance to the manufacturing activity to alleviate the difficulty.

C. VENDOR QUALITY CONTROL COVERAGE

Quality control surveillance is required of all vendors producing units or subunits. Vendor quality control surveillance is provided by either the RCA-DEP Field Quality Control activity, or the project Product Assurance group. Product Assurance personnel are assigned to the vendor's plant for the duration of the vendor's contract. The DEP Field Quality Control activity furnishes coverage at the vendor's plant periodically, upon written request from the project Quality Control office.

SECTION II

TAGS, FORMS AND LOGS

A. INTRODUCTION

The purpose and use of each tag or form required by the program is described in the following paragraphs. The type of information required in each entry space and the personnel required to make the entry is also explained. The tags and forms required are:

1) Traveler Tag
2) Environmental Test Tag
3) Test Status Report
4) Unit Performance Record
5) Quality Control Audit Sheet
6) System Integration Area Log Sheet

B. TRAVELER TAG

1. Purpose

The traveler tag (see Figure II-1) will be attached to the item at the first stage in the manufacturing process. It will be attached by the wiremen when the item is being assembled by the production activity, or by the technician when the item is being assembled by the engineering activity. An item going through the manufacturing process shall have a traveler tag attached to it at all times, except where the tag is liable to interfere with a manufacturing process. When a traveler tag is removed from an item, it shall be guarded against loss or separation from the item, but it should be available at all times for review by the quality control inspector. The traveler tag will be dated and stamped or initialed as the item proceeds through the steps in the manufacturing process. The purposes of the traveler tag are:

a) Identification: An item that is not identified by a name plate can be identified by the attached traveler tag.

b) Process Control: By reviewing the traveler tag, the Quality Control office can ascertain that all the previous steps in the manufacturing process have been completed and are controlled.

c) Quality Control: The traveler tag serves as a record to show that the item has had all the necessary inspections to be assured of a quality product.

d) Item Status Report: The traveler tag indicates what portions of the manufacturing process have been completed on the item.

e. Special Manufacturing Instructions: The "Rework" block on the reverse side of the traveler tag is used to list class "B" standard repair list instructions and any applicable engineering change notices which would affect the manufacturing process.

2. Function

After a unit receives its final quality control inspection, the accompanying records will be filed. The traveler tag will stay attached to the unit until it is assembled on the spacecraft. At this time, the traveler tag is removed from the unit and placed in an envelope with all traveler tags of other units being assembled to the spacecraft. The envelope containing all the traveler tags will be filed in a readily available location. When the units are assembled on the next higher assembly or on the spacecraft, a traveler tag for the next higher assembly or the spacecraft will be attached.

3. Description

The following is a description of the information to be included in each of the entry blocks on the front side of the tag:

a) Title: The item name or title shall be entered in this area.

b) Serial No.: The serial number of the item, the prototype number, or flight model number with which the item is to be used shall be entered in this area.

c) Shop Order (S. O.): Enter the shop order number applicable to the item.

d) Contract: Enter the applicable contract number.

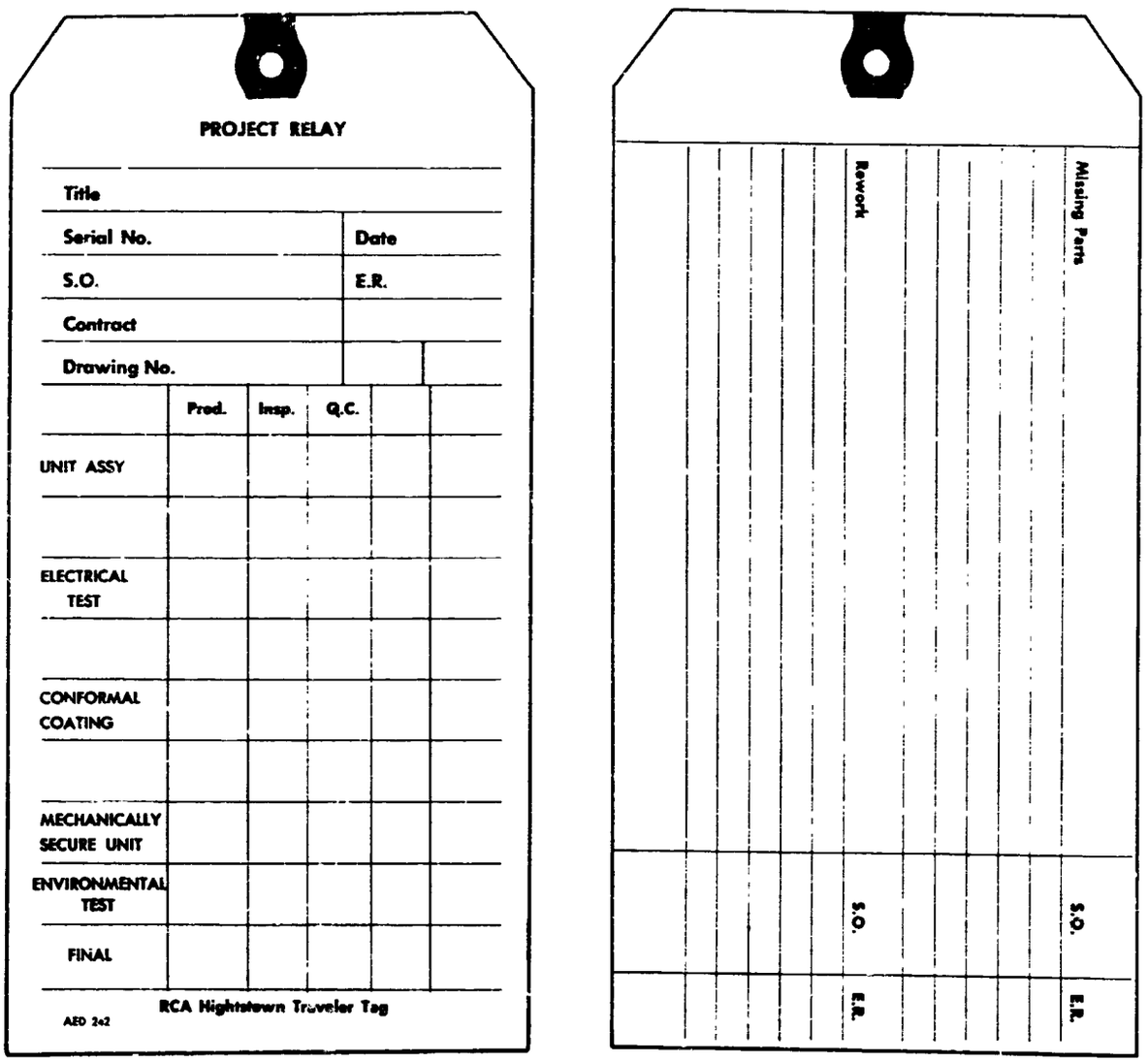

Figure II-1. Traveler Tag, Front and Back Views

e) Drawing No.: Enter the assembly drawing number located in the title block of the drawing which accompanies the item.

f) Date: Enter the day, month, and year the traveler tag is attached to the item.

g) Engineering Request (E. R.): Enter the engineering request number for producing the item.

h) Production (PROD.): A stamp or the initials of the wiremen, technician or operator completing a function in the manufacturing process shall be entered in this area.

i) Inspection (INSP.): The production inspector shall place his stamp and date in this area when an item has the inspector's approval for a manufacturing process function.

j) Quality Control (Q. C.): The quality control inspector shall place his stamp and date in this area after he approves an item. The quality control stamp verifies that the unit meets the inspector's approval, that all previous manufacturing functions on the item have been completed, and that the traveler tag is filled out properly.

k) Unit Assembly (Unit Assy.): The blocks to the right in this area will be stamped or initialed when the process is completed.

l) Electrical Test: This shall be initialed by the engineer performing the test to indicate that the test was satisfactorily completed. The engineer shall place his initials in the "Prod." column. The quality control test monitor shall place his initials under the "Q. C." column.

m) Conformal Coating: The technician or operator shall enter his initials under the "Prod." column after he has completed conformal coating the unit. The quality control inspector will enter his stamp of approval in the "Q. C." column.

n) Mechanically Secure Unit: The technician shall place his initials or stamp under the "Prod." column after he has mechanically secured the unit. The production inspector shall inspect the unit and place his stamp under the "Insp." column after approval. Approval by the quality control inspector shall be verified by a stamp appearing in the "Q. C." column.

o) Environmental Test: The Project Relay ervironmental test engineering leader shall place his initials under the "Insp." column after the unit has satisfactorily completed the environmental tests. The quality control test monitor shall place his stamp or initials under the "Q. C." column after the unit has satisfactorily completed the environmental tests.

p) Final: The quality control inspector shall place his stamp in this area after he has inspected the unit which has completed environmental tests and makes sure the records and tags are complete.

NOTE: The margin at the top of the tag can be used for any additional identifying information.

The following is a description of the information to be included in each of the entry blocks on the reverse side of the traveler tag.

a) Missing Parts: This space will be used to indicate all parts that are missing from the unit at the time the unit is submitted for inspection. Each part will be listed by its part reference designation. As each part is installed and the installation is approved, the inspector will place his stamp by the part reference designation listed in this space.

b) Shop order (S. O.): The shop order number of the unit will be entered in this area.

c) Engineering Request (E. R.): The engineering request number for the unit will be entered in this area.

d) Rework: Any rework to the unit after quality control acceptance will be entered in this area. The quality control inspector will place his stamp by the description of the rework as it is inspected and approved.

e) Shop Order (S. O.): The shop order number for the unit will be entered in this area when rework is required.

f) Engineering Request (E. R.): The engineering request number describing the nature of the rework to the production area will be entered in this area.

C. ENVIRONMENTAL TEST TAG

1. Purpose

The environmental test tag (see Figure II-2) shall be attached to the unit and completed by the environmental simulation department personnel.

The purpose of the environmental test tag is to show that a unit has been through the environmental tests. It also indicates which portions of the environmental tests have been completed satisfactorily.

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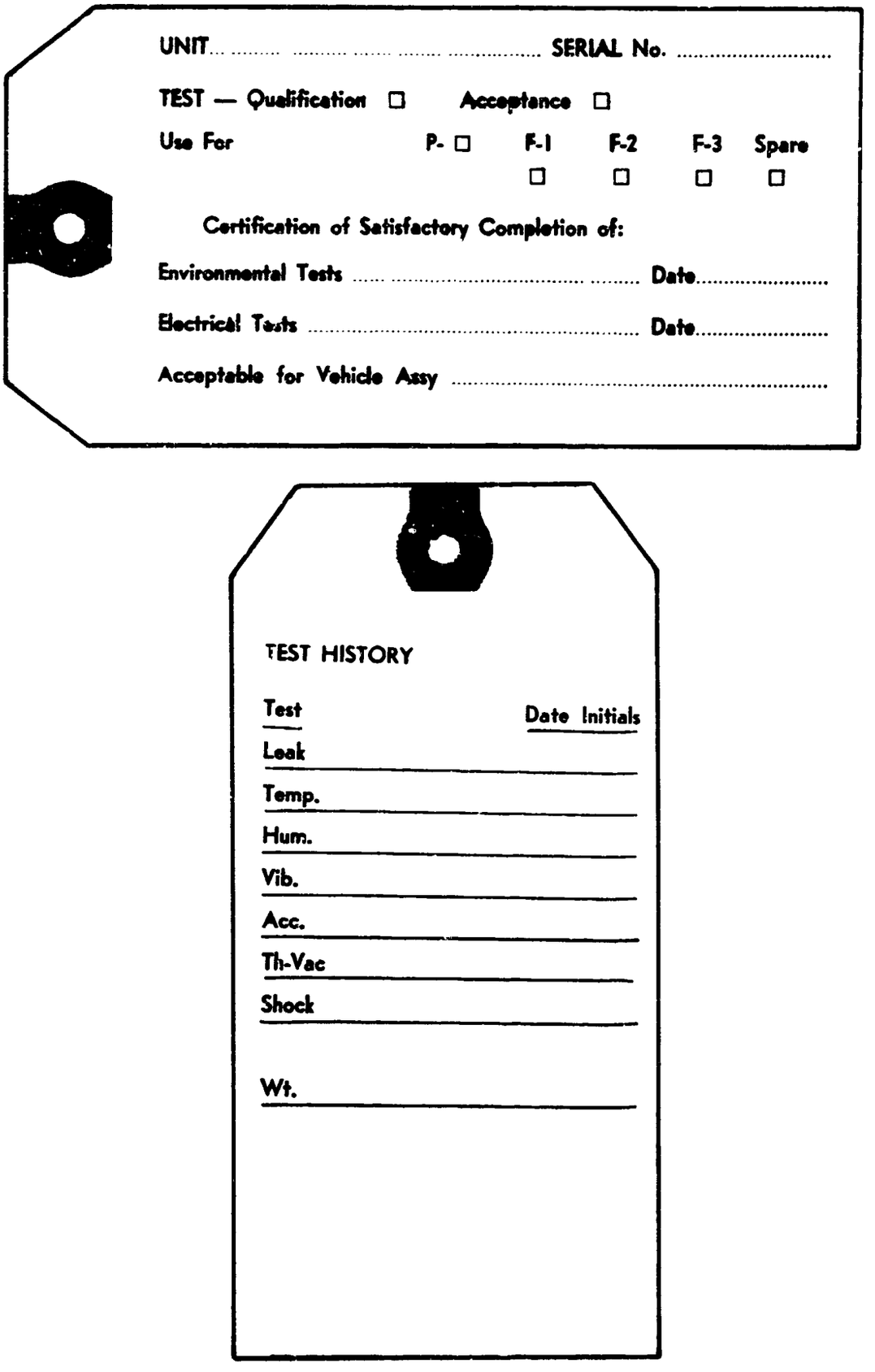


Figure II-2. Environmental Test Tag, Front and Back Views

i) Acceptable for Vehicle Assembly: This block shall be signed by project management after the Environmental Tests and Electrical Tests blocks have been signed by the cognizant engineers.

j) Test History; Leak, Temperature (Temp.), Humidity (Hum.), Vibration (Vib.), Acceleration (Acc.), Thermal-Vacuum (Th-Vac), and Shock: These blocks shall be initialed by the engineer performing each test as they are completed satisfactorily.

k) Date Initials: The engineer shall enter the day, month, and year that each test which is listed in left hand column is completed.

l) Weight (Wt.): The weight of the unit, measured in pounds or grams to the nearest tenth, will be entered in this area along with the initials of the system integration engineer.

D. TEST STATUS REPORT

1. Purpose

The report shall be completed by the quality control personnel assigned to monitor the environmental and electrical tests. Copies of this report shall be submitted to the Project Quality Control office and the Project Product Assurance office on a weekly basis.

The purpose of the test status report (see Figure II-3) is to provide the Quality Control and Product Assurance offices with a record of the units being electrically and environmentally tested. The report also indicates the portions of electrical and environmental tests that have been completed on a unit. In the case of a unit failure during testing, the record gives a summary report of the time of failure and the test under which the failure occurred.

2. Description

A description of the entry blocks on the report and the information to be included are as follows:

a) Q.C. and P.A. Monitor Activity: Enter the names of the persons in the Quality Control office and Product Assurance office who are to receive a copy of the report.

b) Report Date: Enter the day, month, and year the report is being submitted.

PROJECT RELAY TEST STATUS REPORT

Q.C & P.A. MONITOR ACTIVITY							REPORT DATE			
Unit Desig.	Equipment Name	Type of Test	Location	Test Engr.	Date Start	Date Stop	Test Result	Remarks	Equip. Hrs.	Monitor

Figure II-3. Test Status Report

c) Unit Designation: Enter the prototype number or flight model number of the unit being tested.

d) Equipment Name: Enter the name, or title, and the serial number of the unit under test.

e) Type of Test: Indicate the type of test being performed. If environmental, enter that portion of the environmental test being performed; such as, vibration, acceleration, humidity, thermal-vacuum, etc. If electrical, enter initial bench check, bench check, or bench check after environmental tests.

f) Location: Enter the RCA facility or subcontractor's name where the test is being conducted.

g) Test Engineer (Engr.): Enter both the name of engineer responsible for the unit being tested, and the name of the engineer performing the test.

h) Date:

1) Start: Enter day, month, and year in which the test of the unit was started.

2) Stop: Enter day, month, and year in which the test of the unit was completed, or stopped because of unit malfunction.

i) Test Result: Enter "passed" or "o.k." for a unit satisfactorily completing a test. Enter "rejected" or "no go" for a unit not satisfactorily completing a test.

j) Remarks: Enter all comments pertinent to the test. If the unit did not pass the test, indicate the cause of trouble.

k) Equipment Hours (Equip. Hrs.): Enter the accumulated unit operating time in hours, to the nearest tenth.

l) Monitor: Enter the initials of the quality control man monitoring the test.

E. UNIT PERFORMANCE RECORD

1. Reference

The use, function, and description of the Unit Performance Record is detailed in the RCA, Defense Electronic Products, Inspection Instructions and Procedures Manual, Quality Control Bulletin No. AAA, dated August 11, 1961. The front and back views of the form are shown in Figures II-4 and II-5, respectively.

RCA QUALITY CONTROL
DEFENSE ELECTRONIC PRODUCTS

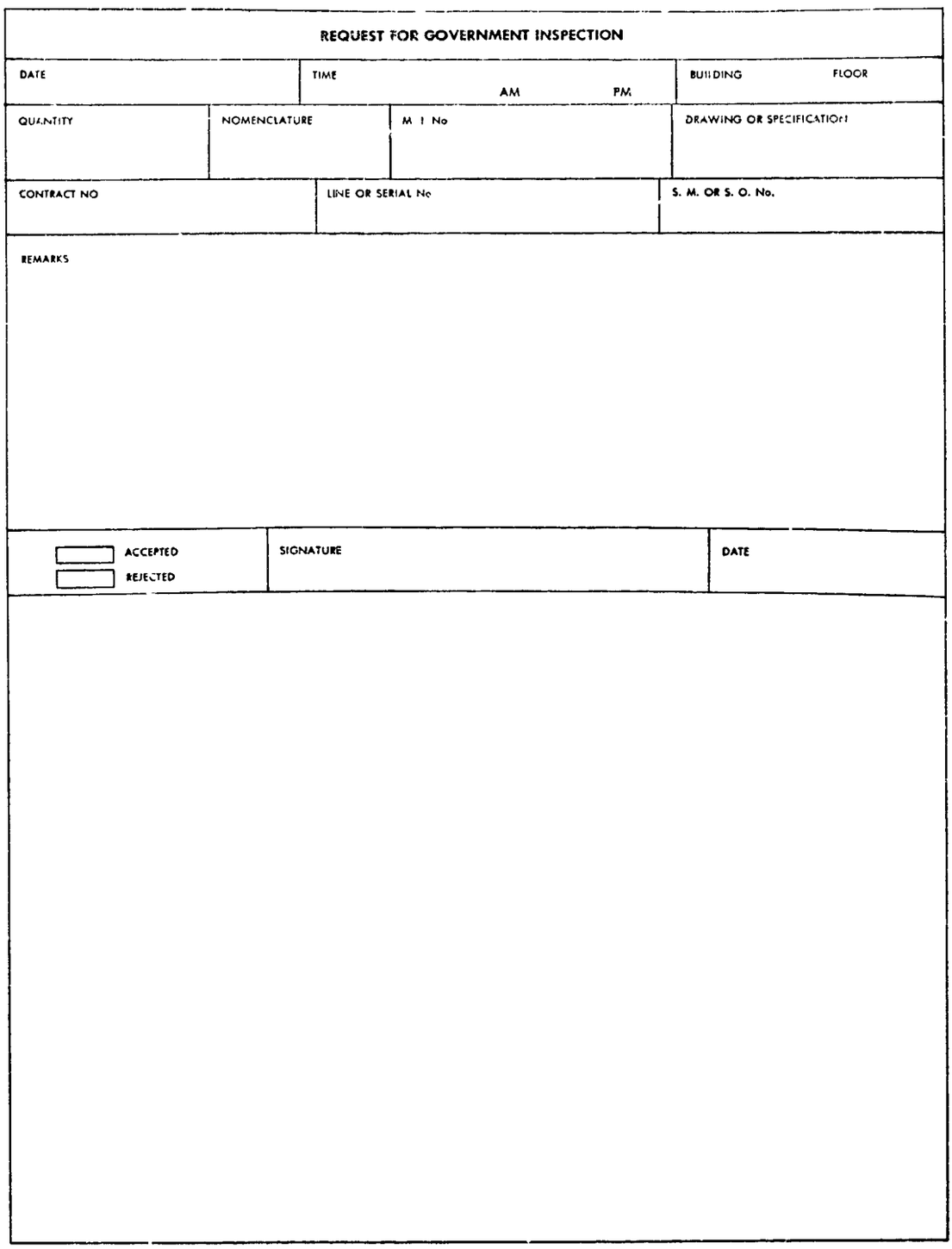
UNIT PERFORMANCE RECORD

SUB-CHASSIS NAME_____ Line #_____

DEF. #	DATE	INSPECTION OR TEST STATION	DEFECT DESCRIPTION	TIME OF FAILURE	INSP-STAMP	REPAIR	REPAIR CHECK OFF	MAJOR	MINOR

DE 243

Figure II-4. Unit Performance Record, Front View



REQUEST FOR GOVERNMENT INSPECTION

DATE	TIME AM PM	BUILDING FLOOR
QUANTITY	NOMENCLATURE	M I No / DRAWING OR SPECIFICATION
CONTRACT NO	LINE OR SERIAL No	S. M. OR S. O. No.

REMARKS

ACCEPTED / REJECTED	SIGNATURE	DATE

Figure II-5. Unit Performance Record, Back View

F. QUALITY CONTROL AUDIT

1. Purpose

The Quality Control Audit (see Figure II-6) summarizes the defects listed on the Unit Performance Record. The audit performs the function of allowing quality control personnel to effectively monitor the inspection procedures and the manufacturing process. By applying a statistical approach to the audit, those processes which are out of control and require corrective action can be gleaned.

The Quality Control Audit will be completed and submitted to the Quality Control office on a weekly basis. A Quality Control Audit sheet will be completed for each serialized unit.

2. Description

A description of the entry blocks on the audit sheet and the information to be included are as follows:

a) Unit Title: Enter the title of the unit on which the audit is to be conducted.

b) RCA Part No.: Enter the RCA part number of the unit.

c) Serial No.: Enter the serial number of the unit.

d) Item No.: For purposes of itemizing the categories of defects, item numbers will be assigned in numerical sequence for each category of defect.

e) Number of Defects: Enter the total number of defects listed for the unit for each category of defect.

f) Defect Description: Enter the description of the defect. A description of the defect category will be entered in this area.

g) Major: This block will be checked if the defect described in the "Defect Description" column is classified as a major defect. Classification of defects is described in the quality control manual.[1]

[1] RCA-DEP, Astro-Electronics Division Quality Control Instruction, Standard Classification of Defects, dated March 1, 1962.

PROJECT RELAY

QUALITY CONTROL AUDIT

Unit Title_____ RCA Part No. _____ Serial No. _____

Item No.	Number of Defects	Defect Description	MAJOR	MINOR	Corrective Action

Figure II-6. Quality Control Audit Sheet

h) Minor: This block will be checked if the defect described in the "Defect Description" column is classified as a minor defect.[1]

i) Corrective Action: Enter a description of the action taken to correct the defect.

G. SYSTEM INTEGRATION AREA LOG SHEET

1. Purpose

The System Integration Area Log Sheet (see Figure II-7) is implemented in the spacecraft system integration area to keep a running inventory list of all units released to the integration area. Units are released to the integration area for the purposes of:

a) Assembly to the test spacecraft structure by integration area personnel to complete the vibration portion of the environmental test, and

b) Storage prior to final assembly to a spacecraft structure.

2. Requirements

To insure that a unit gets full quality control coverage, the following requirements were imposed on the spacecraft system integration area for maintaining the System Integration Area Log Sheet:

a) A unit being submitted to the integration area must have a traveler tag attached.

b) All units released to the integration area must be logged in the System Integration Area Log Sheets.

c) All units submitted to the integration area for storage prior to final assembly to the spacecraft structure must have verification of final approval by quality control personnel on the the traveler tag.

---

[1]Ibid.

d) Units that are logged into the integration area for final assembly will not be taken from the integration area without quality control approval.

e) All units that are to be resubmitted to the integration area for final assembly to the spacecraft structure must have an indication of quality control approval on the attached traveler tag.

3. Description

Instructions for filling out the System Integration Log Sheets are as follows:

a) System No.: Enter the spacecraft system number for the units listed on this page.

b) Date In: Enter the day, month, and year the unit is logged into the integration area.

c) Date Out: Enter day, month, and year the unit is taken from the integration area.

d) Unit Title: Enter the title of the unit being logged in.

e) RCA Part No.: Enter the RCA part number of the unit.

f) Serial No.: Enter the serial number of the unit.

g) Received From (Signature):

1) In: The signature of the person releasing the unit to the integration area should appear here.

2) Out: The signature of the person in the integration area responsible for maintaining the log sheets should appear here when the unit, that has been logged into the integration area, is taken out of the integration area.

h) Received By (Signature):

1) In: The signature of the person in the integration area responsible for maintaining the log sheets should appear here when a unit is released to the integration area.

2) Out: The signature of the person taking the unit out of the integration area should appear here.

i) Unit Weight: The spacecraft system integration area personnel will weigh each unit as it is released to them. The weight of the unit, in grams to the nearest tenth, will be entered in this area.

SYSTEM INTEGRATION AREA LOG SHEET

SYSTEM NO.

Date In	Date Out	Unit Title	RCA Part No.	Serial No.	Received From (signature)	Received By (signature)	Unit Wt.
					In	In	
					Out	Out	
					In	In	
					Out	Out	
					In	In	
					Out	Out	
					In	In	
					Out	Out	
					In	In	
					Out	Out	
					In	In	
					Out	Out	
					In	In	
					Out	Out	
					In	In	
					Out	Out	

*** Unit logged in for final integration must be stamped by Quality Control in the Final block of the traveler tag.**

Figure II-7. System Integration Area Log Sheet

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SECTION III

MANUFACTURING PROCEDURES AND FLOW CHARTS

A. INTRODUCTION

Manufacturing procedures and associated flow charts have been implemented for each unit that is fabricated or assembled at RCA-AED. The procedures and associated flow charts are inspection oriented; they show the points at which production inspection and quality control inspection or surveillance take place.

B. INCOMING PARTS AND MATERIALS HANDLING PROCEDURE

Each lot of parts and materials coming into RCA-AED shall be processed by the receiving and purchased materials inspection (PMI) personnel according to standardized procedures.[1] Typical PMI inspection tags and forms shall be filled out for each lot. Figure III-1 is a flow chart that diagrams the flow of

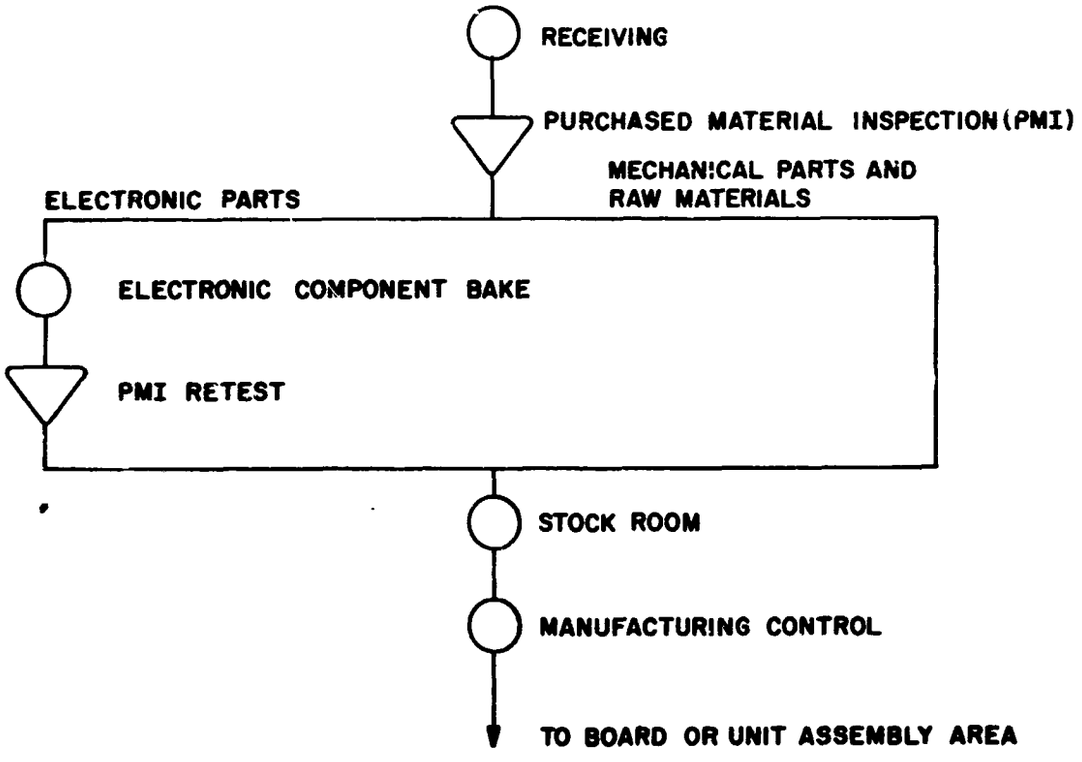

Figure III-1. Incoming Parts and Materials Handling Procedure, Flow Chart

[1] RCA-AED Quality Control Manual, Quality Procedure No. 3413, dated December 6, 1957.

material through these stations. The function and responsibility of each station on the flow chart is as follows:

1) Receiving: All parts and materials coming into RCA-AED from vendors or subcontractors must be logged in through the receiving section.

2) Purchased Material Inspection: All parts and materials coming out of the receiving section will be routed through the PMI section. The PMI section will inspect and test all parts and materials for conformance with specifications, drawings, and standards. Accept-reject criteria for each lot shall conform to inspection instructions. All parts and materials not in conformance with specifications, drawings, and standards are set aside in an area in the PMI section to await disposition. Accepted mechanical parts and raw materials go directly to the stock room, while electronic component parts are processed through the bake cycle.

3) Electronic Component Bake: All electronic component parts are put through the bake cycle as specified in the Subsystem Reliability Requirements-Project Relay, RCA Specification 1171655.

4) PMI Retest: The PMI section will retest electronic component parts after the bake cycle. The procedures for test after bake and the accept-reject criteria are specified in the Subsystem Reliability Requirements-Project Relay, RCA Specification 1171655. All the electronic component parts which are considered acceptable after bake will be transferred to the stock room.

5) Stock Room: The stock room will store all parts and materials coming from PMI.

6) Manufacturing Control: The manufacturing control section assigns the work to be done to the production facility. This includes supplying the production facility with all the applicable drawings and additional production instructions.

C. STANDARD REPAIR PROCEDURE

All repairable items, properly tagged and documented, will be sent to the repair area for rework. The standard repair procedure is diagrammed in the flow chart shown in Figure III-2.

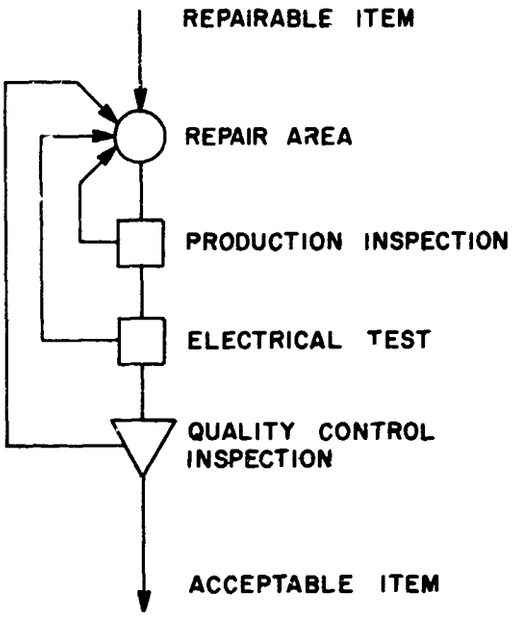

Figure III-2. Standard Repair Procedure, Flow Chart

A repairable item is defined as an assembly, a subassembly, a unit, or a board that is found to vary from applicable drawings, standards or specifications, or fails during either electrical or environmental tests. The variation must be such that it can be corrected by procedures outlined in the Standard Repair List[2]. A repairable item which is not repairable in accordance with the Standard Repair List will be routed to the quality control activity for preliminary review.

The function and responsibility of each station shown in Figure III-2 are as follows:

1) Repair Area: This is the facility where the repair or rework is to be accomplished, whether it be the production activity or the engineering activity.

2) Production Inspection: The production inspector will inspect the repair or rework required to eliminate variations from standards, drawings, or specifications.

[2] RCA-AED Quality Control Manual, Quality Control Instructions, dated December 8, 1961

3) Electrical Test: The repaired or reworked item will undergo electrical test. The item must satisfactorily complete the electrical test.

4) Quality Control: The quality control inspector will inspect the portion of the item that was affected by the repair or rework for conformance to drawings, standards, or specifications.

5) Acceptable Item: An acceptable item is an assembly, subassembly, unit, or board which conforms to drawings, standards and specifications, and is considered acceptable for further processing.

D. BATTERY BOX PROCEDURE

Production inspection and quality control personnel will inspect all boards and subunits of the battery boxes, RCA drawing Nos. 1173896 and 1173897, as outlined in the inspection instructions[3]. Assembly, production, inspection, and quality control will be performed in accordance with the battery boxes in-process manufacturing flow chart (see Figure III-3). Acceptance of a board or subunit by the production inspection or quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

The work performed at stations 1 through 6, 7 through 12, and 13 through 16 may be worked as a parallel effort.

The work performed at each numbered station of the flow chart is as follows:

CAUTION: The battery box must be handled with special care as it is susceptible to damage.

1) Station No. 1: The battery cells will be bonded to the top plate by chemistry laboratory personnel. The traveler tag will be attached.

2) Station No. 2: Wire shop personnel will wire the battery cells.

3) Station No. 3: The production inspector will inspect the wiring.

4) Station No. 4: The quality control inspector will inspect the wiring.

5) Station No. 5: Chemistry laboratory personnel will bond the wires to the plate and paint the top plate.

[3]RCA-AED Quality Control Manual, Quality Procedures No. 701, dated August 5, 1960

6) Station No. 6: The quality control inspector will inspect the wire bond and the painting.

7) Station No. 7: The battery cells will be bonded to the bottom plate by chemistry laboratory personnel. The traveler tag will be attached.

8) Station No. 8: Wire shop personnel will wire the battery cells.

9) Station No. 9: The production inspector will inspect the wiring.

10) Station No. 10: The quality control inspector will inspect the wiring performed at Station No. 8.

11) Station No. 11: Chemistry laboratory personnel will bond the wires to the plate and paint the bottom plate.

12) Station No. 12: The quality control inspector will inspect the wire bond and the painting.

13) Station No. 13: Model shop personnel will install teflon terminals to the central structure.

14) Station No. 14: The production inspector will inspect the teflon terminal installation.

15) Station No. 15: Chemistry laboratory personnel will bond thermistors to the central structure and paint it. A traveler tag will be attached.

16) Station No. 16: The quality control inspector will inspect the thermistor bond and the painting.

17) Station No. 17: The top plate, the bottom plate, and the central structure will be assembled into a unit. The brackets for the connector and the terminal board will be installed. A traveler tag will be attached.

18) Station No. 18: The production inspector will inspect the assembly of the unit.

19) Station No. 19: Wire shop personnel will complete the wiring of the unit.

20) Station No. 20: The production inspector will inspect the completed unit.

21) Station No. 21: The quality control inspector will inspect the unit.

22) Station No. 22: The battery box will undergo electrical tests under the surveillance of a quality control test monitor.

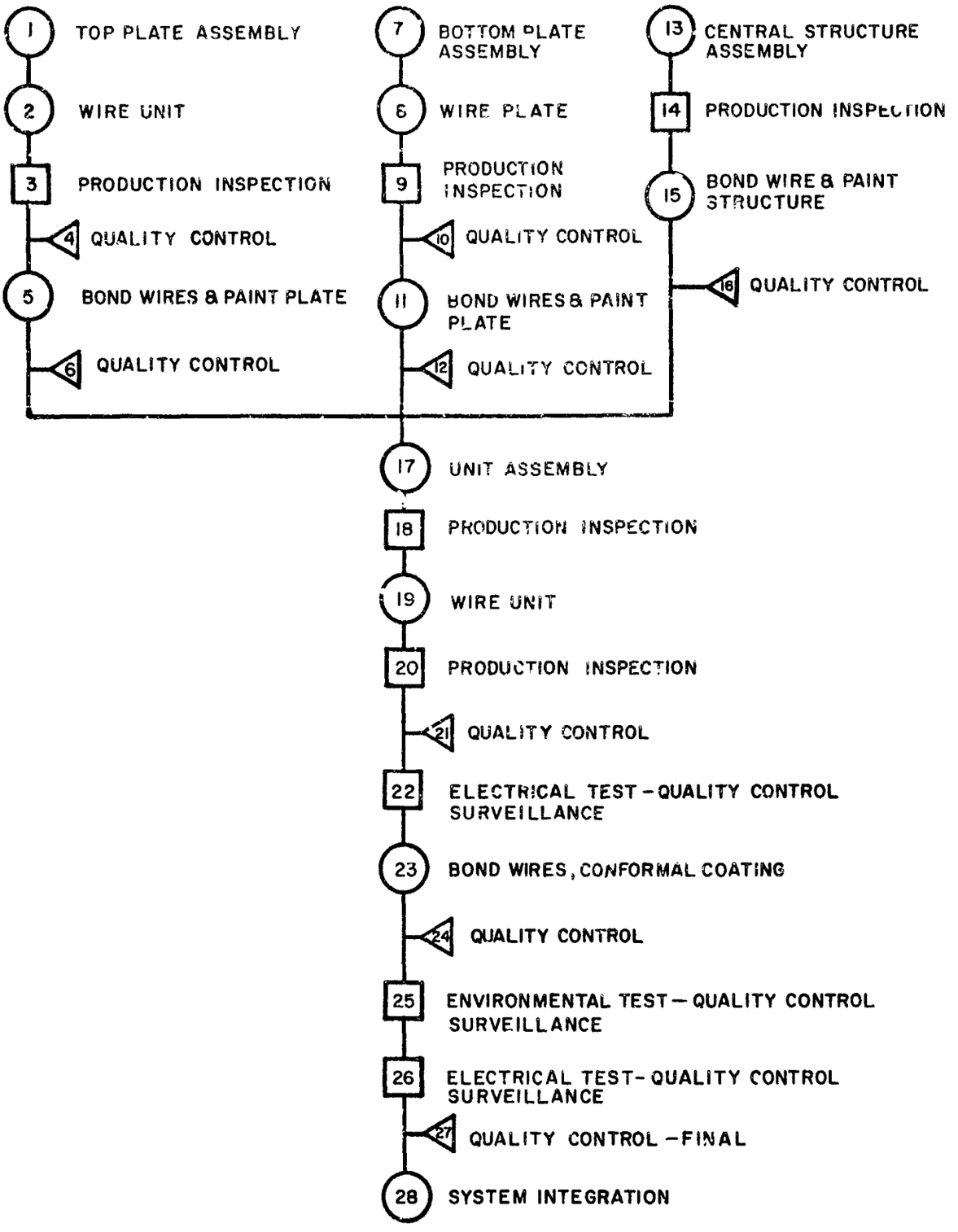

Figure III-3. Battery Box In-Process Manufacturing Flow Chart

23) Station No. 23: Chemistry laboratory personnel will bond wires to the unit and conformal coat all wires, terminals, and the connector.

24) Station No. 24: The quality control inspector will inspect the conformal coating.

25) Station No. 25: The battery box will undergo environmental tests under the surveillance of a quality control test monitor.

26) Station No. 26: Engineering personnel will perform a post-environmental electrical test on the battery box assembly. A quality control test monitor will survey the test.

27) Station No. 27: The quality control inspector will inspect the battery box after environmental and electrical tests to insure that unit was not damaged by the tests or by the handling.

28) Station No. 28: The battery box will be transported to the hold area to await system integration.

E. CHARGE CONTROLLER PROCEDURE

Production inspection and quality control personnel will inspect the charge controller, RCA Drawing No. 1179564, as outlined in the inspection instructions[3]. Subassemblies will be inspected and checked against their individual RCA drawings and specifications. Assembly, production, inspection, and quality control will be performed in accordance with the charge controller in-process manufacturing flow chart (see Figure III-4). Acceptance of a board or subunit by the production inspection or quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

The work performed at stations 1 through 6, 7 through 12, and 13 through 15 may be worked as a parallel effort.

The work performed at each numbered station of the flow chart is as follows:

1) Station No. 1: The component parts of the battery charge controller boards are mounted according to RCA Drawing No. 1706009. Three boards are required for each charge controller. Each board will have its own serial number, and a traveler tag will be attached to each board.

[3] Ibid

2) Station No. 2: The production inspector will inspect the component mounting on each board.

3) Station No. 3: The boards will be dip soldered.

4) Station No. 4: The production inspector will inspect each board, as it completes the dip solder operation.

5) Station No. 5: The quality control inspector will inspect each board.

6) Station No. 6: Each board will be electrically tested by the engineering section.

7) Station No. 7: The component parts of the low voltage pulse generator are assembled according to RCA Drawing No. 1706008. A traveler tag for the board will be attached.

8) Station No. 8: The production inspector will inspect the component mounting on the board.

9) Station No. 9: The low voltage pulse generator board will be dip soldered.

10) Station No. 10: The production inspector will inspect the dip solder of the board.

11) Station No. 11: The quality control inspector will inspect the dip solder of the board.

12) Station No. 12: Electrical test of board will be performed by the engineering section.

13) Station No. 13: The plug assembly and cabling will be soldered according to RCA Drawing No. 1179564. A traveler tag for the plug assembly will be attached.

14) Station No. 14: The production inspector will inspect the plug assembly.

15) Station No. 15: The quality control inspector will inspect the plug assembly.

16) Station No. 16: The required components will be mounted on the unit mounting plate together with the required subassembly boards according to RCA Drawing No. 1179564. The assembly will be temporarily assembled to facilitate inspection of the solder connections of the cable harness to each board and workmanship of the mounting plate components. A traveler tag for the charge controller will be attached.

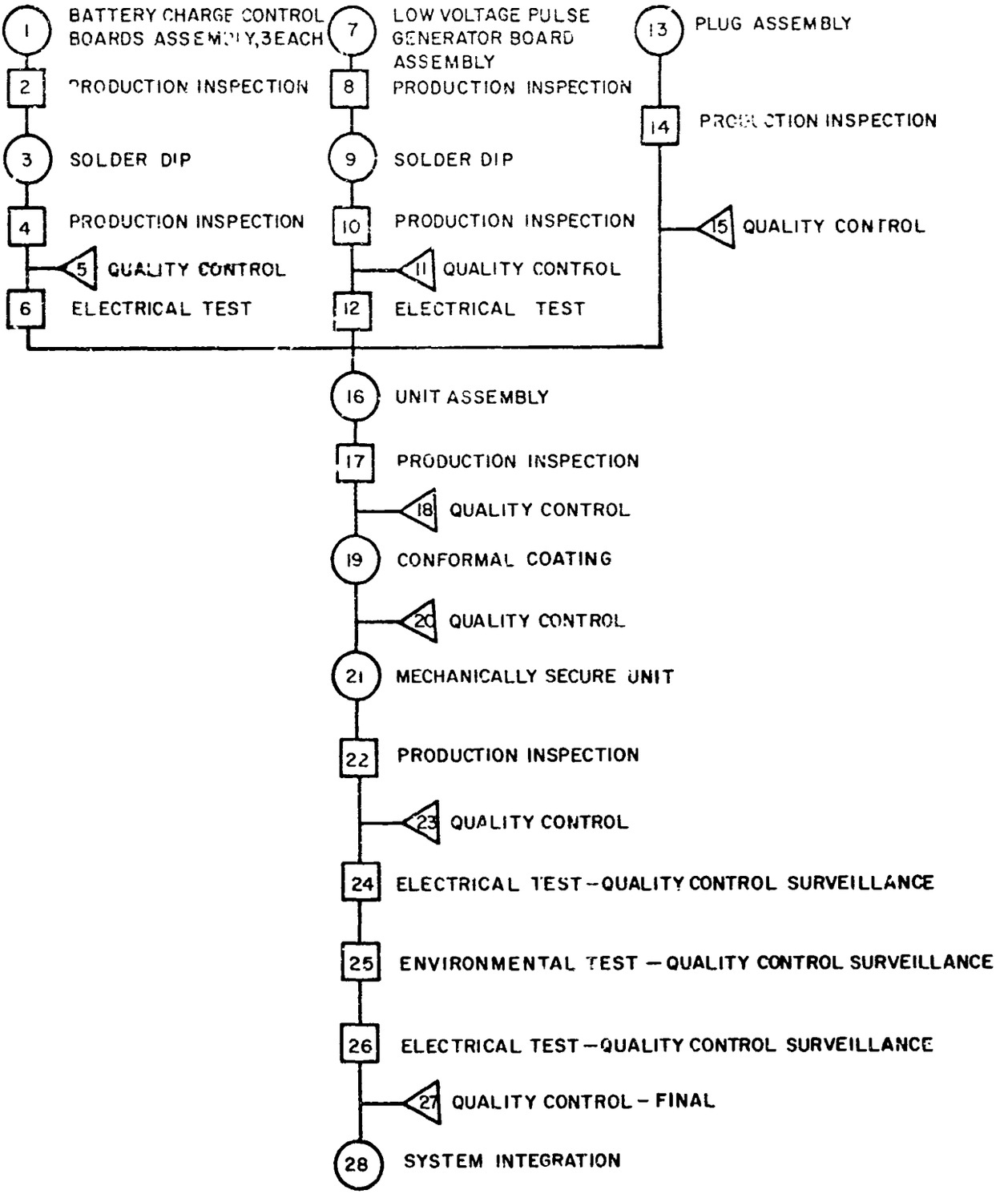

Figure III-4. Charge Controller In-Process Manufacturing Flow Chart

17) Station No. 17: The production inspector will inspect the completed unit.

18) Station No. 18: The quality control inspector will inspect the completed charge controller.

19) Station No. 19: Chemistry laboratory personnel will apply a conformal coating to the unit.

20) Station No. 20: The quality control inspector will inspect the conformal coating.

21) Station No. 21: The charge controller unit will be permanently secured.

22) Station No. 22: The production inspector will inspect the completed, permanently secured unit.

23) Station No. 23: The quality control inspector will inspect the completed unit.

24) Station No. 24: Engineering personnel will perform a functional electrical test, surveyed by the quality control test monitor.

25) Station No. 25: The charge controller will undergo environmental tests. A quality control test monitor will survey the environmental tests.

26) Station No. 26: Engineering personnel will perform a post-environmental electrical test. The test will be surveyed by the quality control test monitor.

27) Station No. 27: The quality control inspector will inspect the completed unit after the environmental tests for all defects caused by the tests and by the handling.

28) Station No. 28: The charge controller unit will be transported to the hold area to await system integration.

F. COMMAND CONTROL BOX PROCEDURE

Production inspection and quality control personnel will inspect all boards and subunits of the command control box, RCA Drawing No. 1179864, as outlined in the inspection instructions[3]. Subassemblies of the unit will be inspected and checked against their individual RCA drawings and specifications. Assembly, production, inspection, and quality control will be performed in accordance with the command control box in-process manufacturing flow chart (see Figure III-5).

[3]Ibid

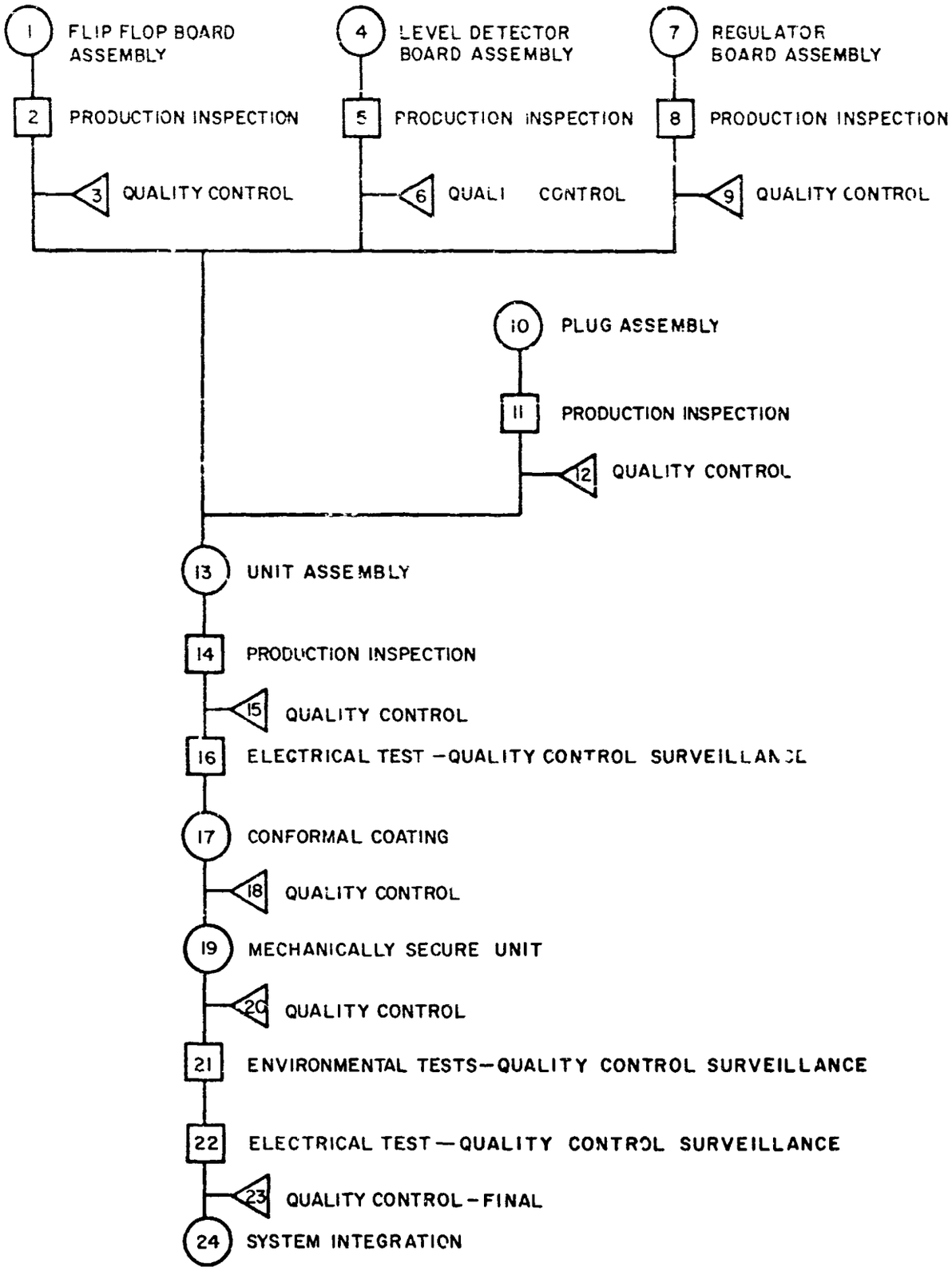

Figure III-5. Command Control Box In-Process Manufacturing Flow Chart

Acceptance of a board or subunit by the production inspection or quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

The work performed at stations 1 through 3, 4 through 6, and 7 through 9 may be worked as a parallel effort.

The work performed at each station of the flow chart is:

1) Station No. 1: Component parts of the flip-flop printed circuit board are assembled according to RCA Drawing No. 1706211. The component parts will be hand soldered in place. A traveler tag will be attached to each board.

2) Station No. 2: The production inspector will inspect all work performed on the flip-flop board. He will also check the component parts against the list of material.

3) Station No. 3: The quality control inspector will inspect the flip-flop printed circuit board.

4) Station No. 4: Component parts of the level detector printed circuit board are assembled according to RCA Drawing No. 1706448. The component parts and the printed circuit will be hand soldered. A traveler tag for the board will be attached.

5) Station No. 5: The production inspector will inspect all work performed on the level detector board. He will also check the component parts against the list of material.

6) Station No. 6: The quality control inspector will inspect the level detector printed circuit board.

7) Station No. 7: Component parts of the regulator printed circuit board assembly are assembled according to RCA Drawing No. 1706212. The component parts and the printed circuit will be hand soldered. A traveler tag for the board will be attached.

8) Station No. 8: The production inspector will inspect all work performed on the regulator board. He will also check the component parts against the list of material.

9) Station No. 9: The quality control inspector will inspect the regulator printed circuit board.

10) Station No. 10: The plug assembly and cabling will be soldered together. A traveler tag for the plug assembly will be attached.

11) Station No. 11: The production inspector will inspect the plug assembly.

12) Station No. 12: The quality control inspector will inspect the plug assembly.

13) Station No. 13: The flip-flop board, the level detector board, the regulator board, and the plug assembly will be assembled into a unit according to RCA Drawing No. 1179864. The unit will be temporarily, mechanically secured to protect the cable harness. A traveler tag for the unit will be attached.

14) Station No. 14: The production inspector will inspect the assembled unit.

15) Station No. 15: The quality control inspector will inspect the assembled unit.

16) Station No. 16: Engineering personnel will electrically test the command control box. The quality control test monitor will survey the electrical test.

17) Station No. 17: The unit will be conformal coated by engineering area personnel.

18) Station No. 18: The quality control inspector will inspect the conformal coating.

19) Station No. 19: The unit will be mechanically secured inside the command control box metal case. The individual boards will be secured into place by this operation.

20) Station No. 20: The quality control inspector will inspect the encased unit.

21) Station No. 21: The command control box will undergo environmental tests under the surveillance of the quality control test monitor.

22) Station No. 22: Engineering personnel will electrically test the unit to insure that the unit was not damaged by the environmental tests. The quality control test monitor will survey the electrical test.

23) Station No. 23: The quality control inspector will inspect the completed unit after the electrical test for all defects caused by the environmental tests and by the handling.

24) Station No. 24: The command control box will be transported to the hold area to await system integration.

G. COMMAND RECEIVER PROCEDURE

Production inspection and quality control personnel will inspect the command receiver, RCA Drawing No. 1179334, as outlined in the inspection instructions[3]. Subassemblies of the unit will be inspected and checked against their individual RCA drawings and specifications, Assembly, production, inspection, and quality control will be performed in accordance with the command receiver unit in-process manufacturing flow chart (see Figure III-6). Acceptance of a board or subunit by the production inspection and quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

The work performed at each numbered station of the flow chart is as follows:

1) Station No. 1: The printed circuit boards for the command receiver will be fabricated and assembled at RCA-Croyden.

2) Station No. 2: RCA-AED PMI personnel will inspect the receiver circuit boards for damage due to shipping and handling.

3) Station No. 3: The case into which two receiver circuits are mounted will be fabricated by the model shop according to RCA Drawing No. 1178671. A traveler tag will be attached to the case.

4) Station No. 4: The production inspector will inspect the case fabrication.

5) Station No. 5: The quality control inspector will inspect the case fabrication.

6) Station No. 6: The receiver circuits will be assembled into the case according to RCA Drawing No. 1178671. A traveler tag will be attached to the assembled unit.

7) Station No. 7: An electrical test will be performed on the command receiver circuits mounted in the case. The quality control test monitor will survey the electrical test.

8) Station No. 8: Engineering personnel will disassemble the unit and apply a conformal coating to the receiver circuit boards.

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[3] Ibid.

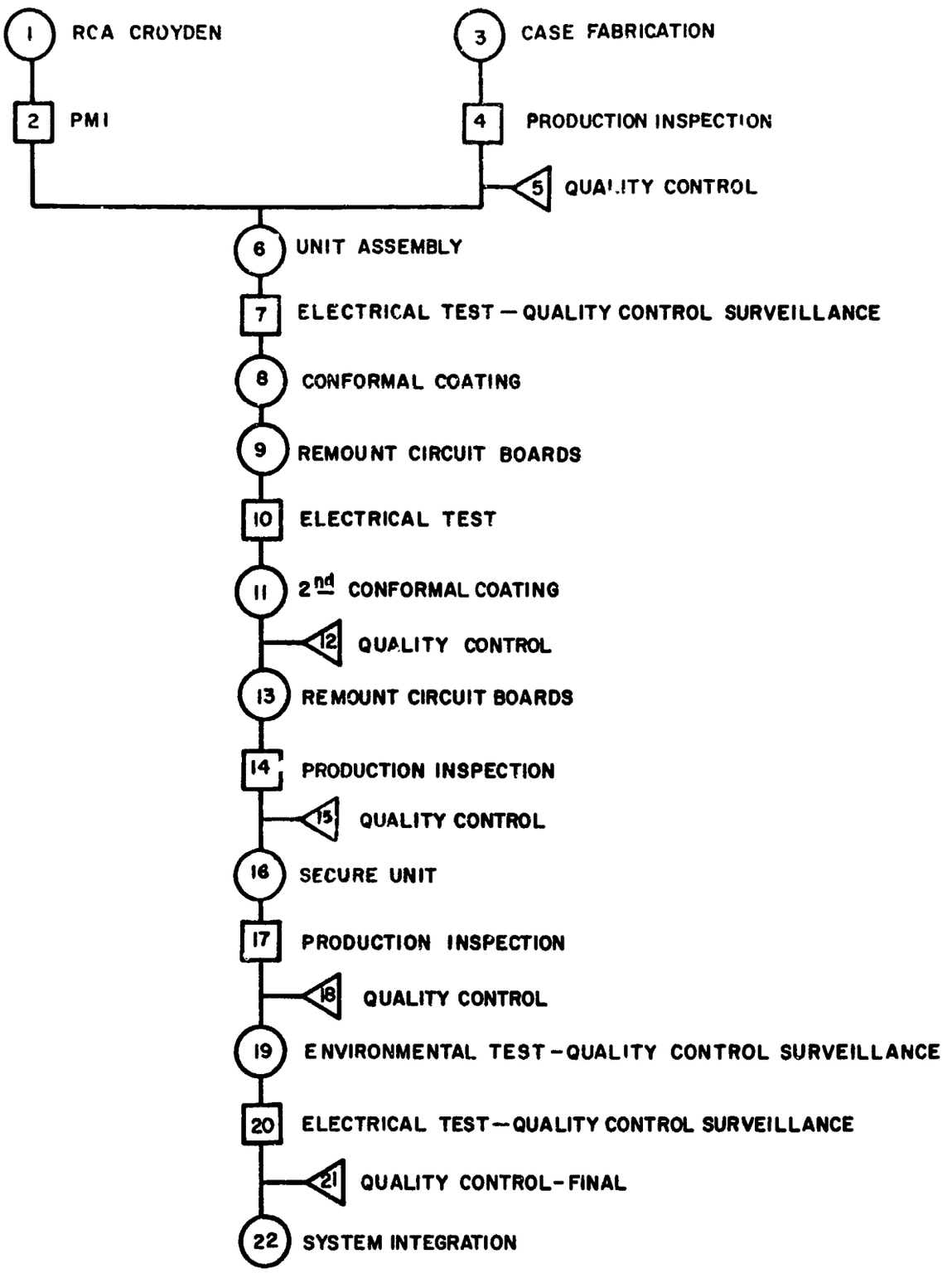

Figure III-6. Command Receiver Unit In-Process Manufacturing Flow Chart

9) Station No. 9: The receiver circuit boards will be remounted into the case.

10) Station No. 10: An electrical test will be performed on the unit to make sure that the conformal coat did not change any of the characteristics of the receiver circuits.

11) Station No. 11: Engineering personnel will again disassemble the unit and apply a second conformal coating to the receiver circuit boards.

12) Station No. 12: The quality control inspector will inspect the receiver circuit boards' conformal coating.

13) Station No. 13: The receiver circuit boards will be remounted in the case.

14) Station No. 14: The production inspector will inspect the receiver circuit boards mounted in the case. The top and bottom lids of the case will be temporarily mechanically secured so that they can be removed to inspect the circuit boards' mountings.

15) Station No. 15: The quality control inspector will inspect the circuit boards' mountings.

16) Station No. 16: The case lids of the command receiver unit will be secured to the case.

17) Station No. 17: The production inspector will inspect the encased unit.

18) Station No. 18: The quality control inspector will inspect the encased unit.

19) Station No. 19: The command receiver unit will undergo environmental tests under the surveillance of the quality control test monitor.

20) Station No. 20: Engineering personnel will perform a post-environmental electrical test under the surveillance of the quality control test monitor.

21) Station No. 21: The quality control inspector will inspect the completed unit after environmental testing and handling. Engineering personnel will assist the quality control inspector in removing and replacing the case lids.

22) Station No. 22: The command receiver will be transported to the hold area to await system integration.

H. CURRENT CONTROLLER PROCEDURE

Production inspection and quality control sections will inspect the current controller, RCA Drawing No. 1706130, as outlined in the inspection instructions[3]. Subassemblies of the unit will be inspected and checked against their individual RCA drawings and specifications. Assembly, production, inspection, and quality control will be performed in accordance with the current controller unit in-process manufacturing flow chart (see Figure III-7). Acceptance of a board or subunit by the production inspection or quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

The work to be performed at each station of the flow chart is as follows:

1) Station No. 1: The transistor and connector mounting brackets of the mounting collar assembly will be assembled according to RCA Drawing No. 1706175. Chemistry laboratory personnel will paint the mounting collar assembly. A traveler tag will be attached to the assembly.

2) Station No. 2: The production inspector will inspect the mounting collar assembly.

3) Station No. 3: The quality control inspector will inspect the mounting collar assembly.

4) Station No. 4: Eight transistors, with thermistors bonded by chemistry laboratory personnel to seven of the transistors, and the connector will be mounted on their respective mounting brackets on the mounting collar assembly according to RCA Drawing No. 1706130. Intercabling of the unit will be completed. A traveler tag will be attached to the unit.

5) Station No. 5: The production inspector will inspect the transistor mounting, the connector mounting, and the intercabling.

6) Station No. 6: The quality control inspector will inspect the thermistor bond to the transistors, the transistor mounting, the connector mounting, and the intercabling.

7) Station No. 7: The current controller will be electrically tested by the engineering personnel. The quality control test monitor will survey the electrical test.

[3] Ibid.

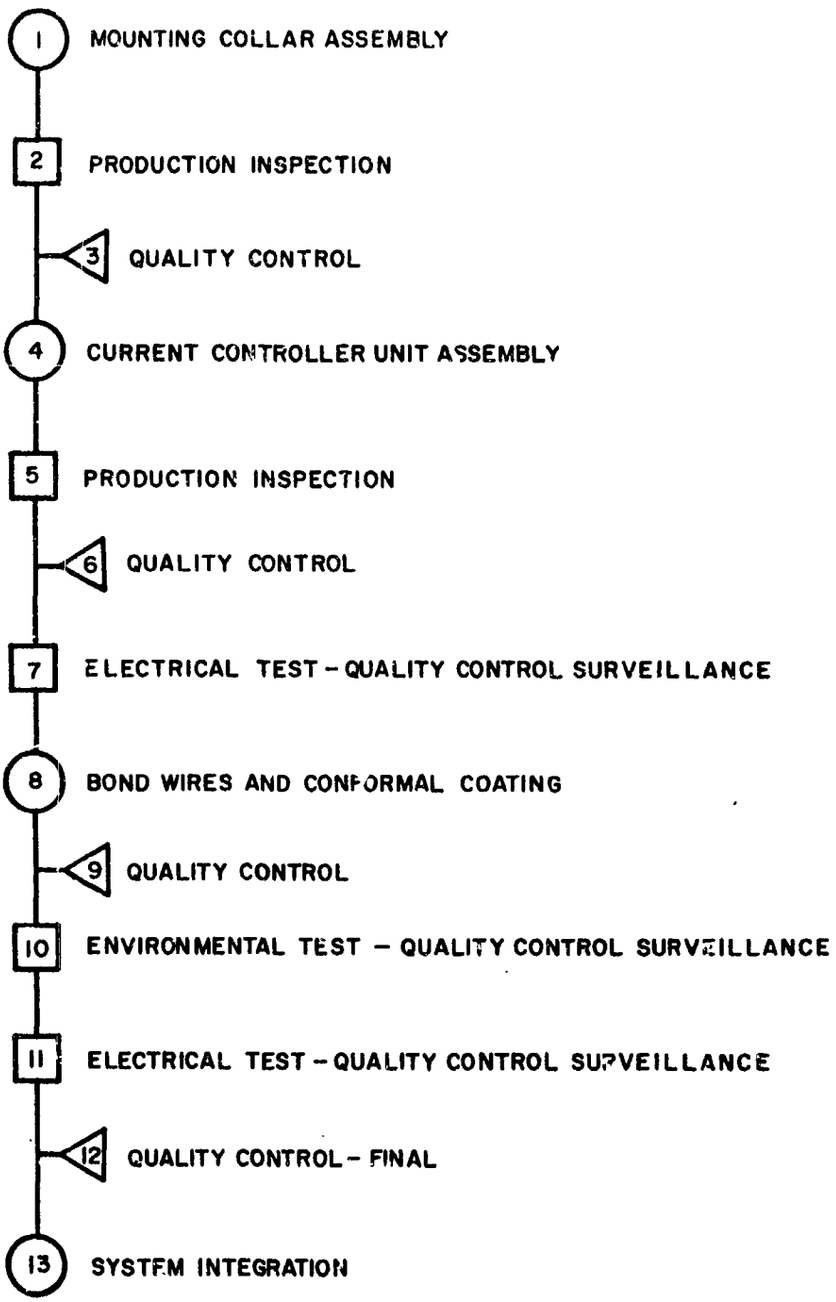

Figure III-7. Current Controller In-Process Manufacturing Flow Chart

8) Station No. 8: Chemistry laboratory personnel will bond the wires and conformal coat all electronic parts as called out by RCA Drawin No. 1706130.

9) Station No. 9: The quality control inspector will inspect the bonding and conformal coat.

10) Station No. 10: The current controller will undergo environmental testing under the surveillance of the quality control test monitor.

11) Station No. 11: Engineering personnel will give the current controller a post-environmental electrical test. The test will be surveyed by the quality control test monitor.

12) Station No. 12: The quality control inspector will inspect the completed current controller after environmental testing for all defects caused by the tests and by the handling.

13) Station No. 13: The current controller unit will be transported to the hold area to await system integration.

I. HORIZON SCANNER PROCEDURE

Production inspection and quality control personnel will inspect all boards and sub units of the horizon scanner, RCA Drawing No. 1706045, as outlined in the inspection instructions[3]. Subassemblies of the unit will be inspected and checked against their individual RCA drawings and specifications. Assembly, production, inspection, and quality control will be performed in accordance with the horizon scanner in-process manufacturing flow chart (see Figure III-8). Acceptance of a board or subunit by the production inspection or quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

The work performed at stations 1 through 9 and 10 through 17 may be worked as a parallel effort.

The work performed at each numbered block of the flow chart is as follows:

1) Station No. 1: Component parts, except the feedback resistor, are assembled on the pulse amplifier board according to RCA Drawing No. 1707183. A traveler tag for the board will be attached.

[3] Ibid.

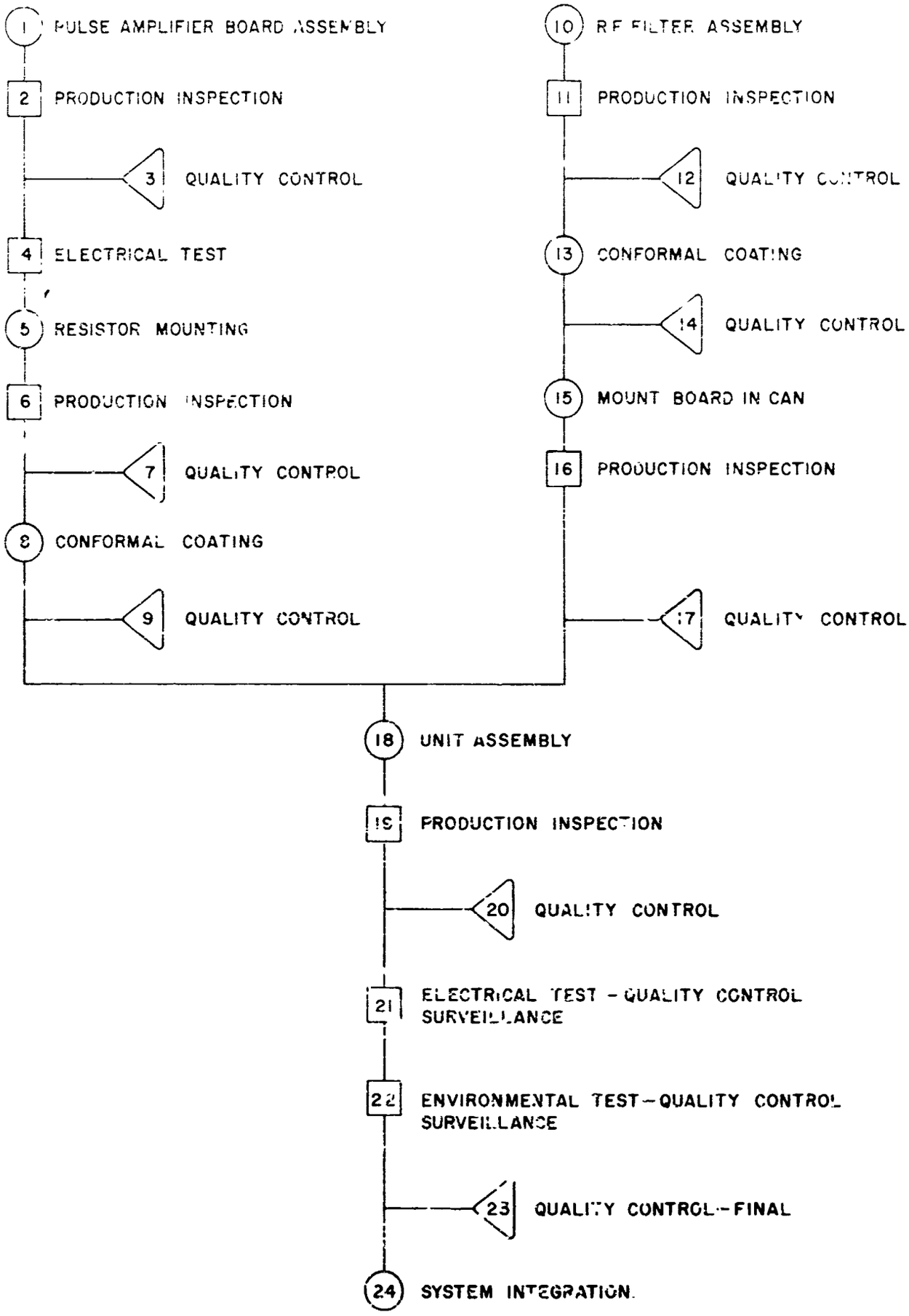

Figure III-8. Horizon Scanner In-Process Manufacturing Flow Chart

2) Station No. 2: The production inspector will inspect all work performed on the pulse amplifier board.

3) Station No. 3: The quality control inspector will inspect the pulse amplifier board.

4) Station No. 4: The engineer will test the board to determine the proper value of feedback resistor in order that the electrical function of the board meets specifications.

5) Station No. 5: Production personnel will mount the feedback resistor on the board.

6) Station No. 6: The production inspector will inspect the mounting of the feedback resistor and will check for defects caused by handling.

7) Station No. 7: The quality control inspector will inspect the mounting of the feedback resistor.

8) Station No. 8: The board will go to the chemistry laboratory for conformal coating.

9) Station No. 9: The quality control inspector will inspect the conformal coating.

10) Station No. 10: Component parts are assembled on the RF filter board according to RCA Drawing No. 1707632. The traveler tag for the board will be attached.

11) Station No. 11: The production inspector will inspect the RF filter board.

12) Station No. 12: The quality control inspector will inspect the RF filter board.

13) Station No. 13: Chemistry laboratory personnel will apply the conformal coating.

14) Station No. 14: The quality control inspector will inspect the conformal coating.

15) Station No. 15: The board is mounted into the cylinder.

16) Station No. 16: The production inspector will inspect the cylinder for proper mounting as described on RCA Drawing No. 1707632.

17) Station No. 17: The quality control inspector will inspect the cylinder for proper mounting as described on RCA Drawing No. 1707632.

18) Station No. 18: The pulse amplifier board, RF filter board, and the subcarrier oscillator are assembled into the horizon scanner case according to RCA Drawing No. 170645. A traveler tag for the unit will be attached.

19) Station No. 19: The production inspector will inspect the completed horizon scanner assembly.

20) Station No. 20: The quality control inspector will inspect the horizon scanner assembly.

21) Station No. 21: The final electrical test will be performed by the engineer to check that the completed unit meets the required specifications. The test will be surveyed by a quality control test monitor.

22) Station No. 22: Environmental test will be performed on the horizon scanner assembly under the surveillance of a quality control test monitor.

23) Station No. 23: The quality control inspector will inspect the completed assembly after environmental tests for defects caused by the environmental tests and by the handling.

24) Station No. 24: The horizon scanner assembly will be transported to the hold area to await system integration.

J. SIGNAL CONDITIONER PROCEDURE

Production inspection and quality control sections will inspect the signal conditioner, RCA Drawing No. 1179789, as outlined in the inspection instructions[3]. Subassemblies of the unit will be inspected and checked against their individual drawings and specifications. Assembly, production, inspection, and quality control will be performed in accordance with the signal conditioner in-process manufacturing flow chart (see Figure III-9). Acceptance of a board or subunit by the production inspection or quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

The work performed at each station of the flow chart is as follows:

1) Station No. 1: Component parts will be assembled on each of the following printed circuit boards according to their respective RCA assembly drawing.

[3]Ibid.

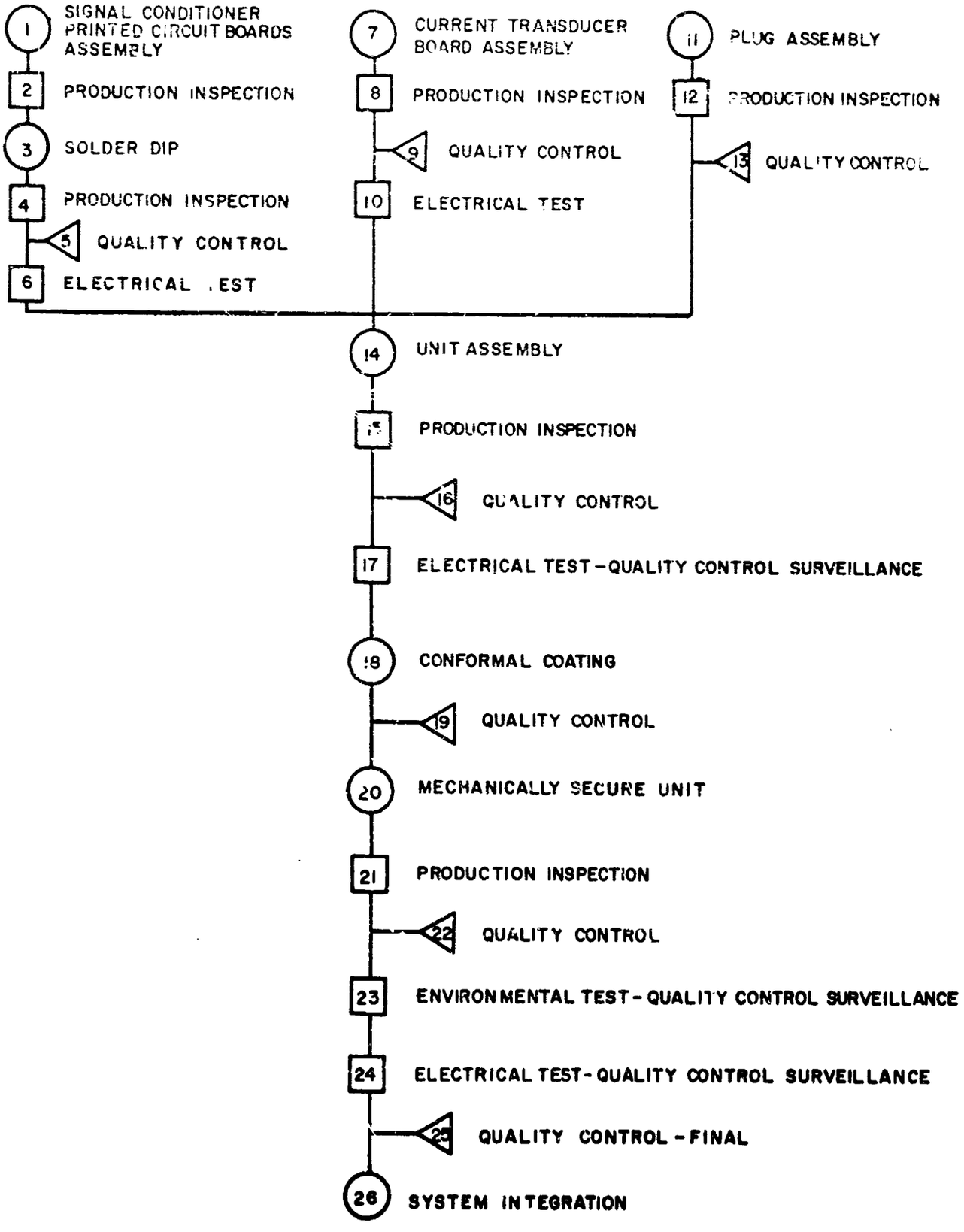

Figure III-9. Signal Conditioner In-Process Manufacturing Flow Chart

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14) Station No. 14: The components and assembled printed circuit boards will be assembled according to RCA Drawing No. 1179789. The unit will be temporarily mechanically secured. A traveler tag for the assembled unit will be attached.

15) Station No. 15: The production inspector will inspect the signal conditioner.

16) Station No. 16: The quality control inspector will survey the signal conditioner inspection.

17) Station No. 17: Engineering personnel will perform an electrical test on the signal conditioner. A quality control test monitor will survey the electrical test.

18) Station No. 18: The unit will be conformal coated by chemistry laboratory personnel.

19) Station No. 19: The quality control inspector will inspect the conformal coating.

20) Station No. 20: The signal conditioner will be permanently secured.

21) Station No. 21: The production inspector will inspect the unit after it is mechanically secured.

22) Station No. 22: The quality control inspector will inspect the unit.

23) Station No. 23: The signal conditioner will undergo envrionmental testing under the surveillance of a quality control test monitor.

24) Station No. 24: Engineering personnel will perform a post-environmental electrical test. A quality control test monitor will survey the test.

25) Station No. 25: The quality control inspector will inspect the completed unit after environmental testing for all defects caused by testing and by handling.

26) Station No. 26: The signal conditioner will be transported to the hold area to await system integration.

K. SOLAR PANELS PROCEDURE

Production inspection and quality control sections will inspect the solar panels as outlined in the inspection instructions[3]. Each solar panel will be processed according to its individual assembly and wiring diagram listed in Table III-1. Assembly, production, inspection, and quality control will be performed in accordance with the solar panel in-process manufacturing flow chart (see Figure III-10). Acceptance of a solar panel by the production inspection or quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

Table III-1. Solar Panels Drawing and Reference Numbers

Wiring Diagram Drawing Number	Assembly Drawing No.	Panel Reference No.
1173878	1173839	1A
1173978	1173976	1B
1173979	1173977	2A
1173876	1173842	2B
1173880	1173840	3A
1173879	1173841	3B
1173881	1173844	4A
1173877	1173843	4B

The work performed at each station of the flow chart is as follows:

1) Station No. 1: RCA-Gloucester personnel will fabricate the aluminum honeycomb panels and will attach four clips to each panel.

2) Station No. 2: RCA-AED PMI personnel will check the aluminum honeycomb panels for dimensions and other specifications prior to the panels being sent to Hoffman Electronics.

[3] Ibid.

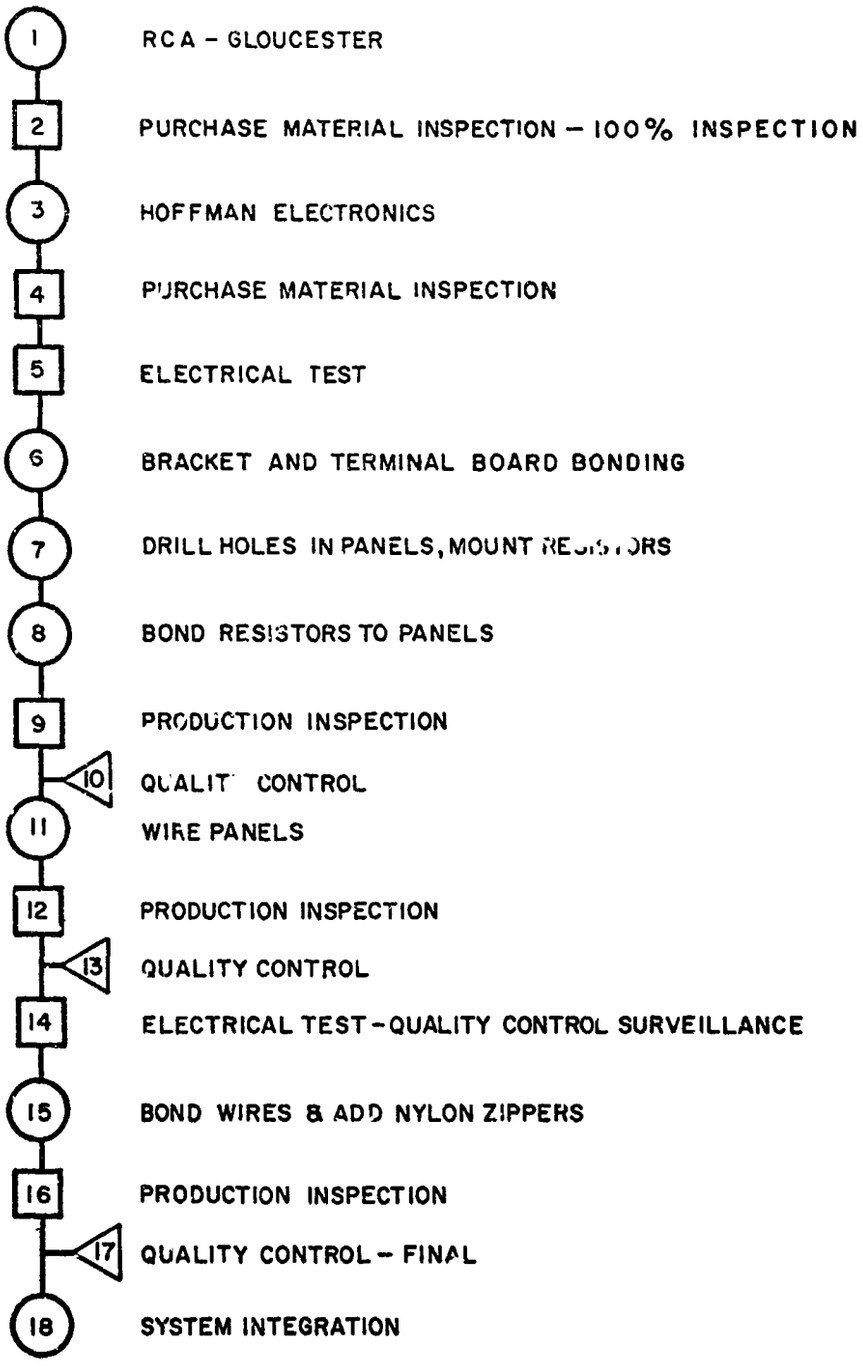

Figure III-10. Solar Panel In-Process Manufacturing Flow Chart

3) Station No. 3: Hoffman Electronics personnel will attach the solar cell shingles to the panels and will wire the cells together.

4) Station No. 4: RCA-AED PMI personnel will inspect the solar panels received from Hoffman. The solar panels will be received with three wires from the solar cells hanging loose. They will visually inspect each solar panel for shipping or handling damage.

5) Station No. 5: Engineering personnel responsible for the solar panels will electrically test each solar panel by means of the tungsten test. A traveler tag will be attached to each solar panel.

6) Station No. 6: Each solar panel will be fabricated according to the RCA drawing listed in Table III-1. A connector and terminal board bracket will be bonded to each of the solar panels. Solar panels 1B, 2A, 3B, and 4A will have a thermistor terminal board bonded to them. The bonding will be done by chemistry laboratory personnel.

7) Station No. 7: Holes will be made in all of the solar panels to feed the wires from the solar cell array to the inside wire connection. Holes will be made in solar panels 1A, 2B, 3A, and 4B for mounting the power resistors to these panels. The power resistors will be screw-fastened to the panels.

8) Station No. 8: Chemistry laboratory personnel will bond the power resistors to the solar panels.

9) Station No. 9: The production inspector will inspect all work performed at stations 6, 7, and 8 for each of the solar panels.

10) Station No. 10: The quality control inspector will inspect each of the solar panels as they proceed through station number 9.

11) Station No. 11: Wiring shop personnel will complete the wiring on the inside of each solar panel.

12) Station No. 12: The production inspector will inspect the wiring.

13) Station No. 13: The quality control inspector will inspect the wiring.

14) Station No. 14: Each of the solar panels will be electrically tested by means of a continuity check. A quality control test monitor will survey the test.

15) Station No. 15: Chemistry laboratory personnel will bond the wires which were added to the solar panels at station 11, to the inside skin. Nylon zippers will be added to the top and bottom edges of the solar panels. The terminal boards on the inside of the solar panels will be conformal coated.

16) Station No. 16: The production inspector will inspect the bonding of the wires, the nylon zipper installation, and the terminal board conformal coating on each solar panel.

17) Station No. 17: The quality control inspector will inspect each set of eight solar panels as they proceed through station 16.

18) Station No. 18: The solar panels for one system (a set of eight) will be transported to the hold area to await system integration.

L. TWT POWER SUPPLY PROCEDURE

Production inspection and quality control sections will inspect the TWT power supply, RCA Drawing No. 1173764, as outlined in the inspection instructions[3]. Subassemblies of the unit will be inspected and checked against their individual RCA drawings and specifications. Assembly, production, inspection, and quality control will be performed in accordance with the TWT power supply in-process manufacturing flow chart (see Figure III-11). Acceptance of a board or subunit by the production inspection or quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

The work performed at stations 1 through 3, 4 through 10, and 11 through 13 may be worked as a parallel effort.

The work performed at each numbered station of the flow chart is as follows:

1) Station No. 1: Components parts will be assembled on the low voltage terminal board according to RCA Drawing No. 1707285. The parts will be hand soldered. A traveler tag for the board will be attached.

2) Station No. 2: The production inspector will inspect all work performed on the low voltage terminal board. The inspector will also inspect that component parts mounted on the board are those called for on the list of material.

3) Station No. 3: The quality control inspector will inspect the low voltage terminal board.

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[3] Ibid.

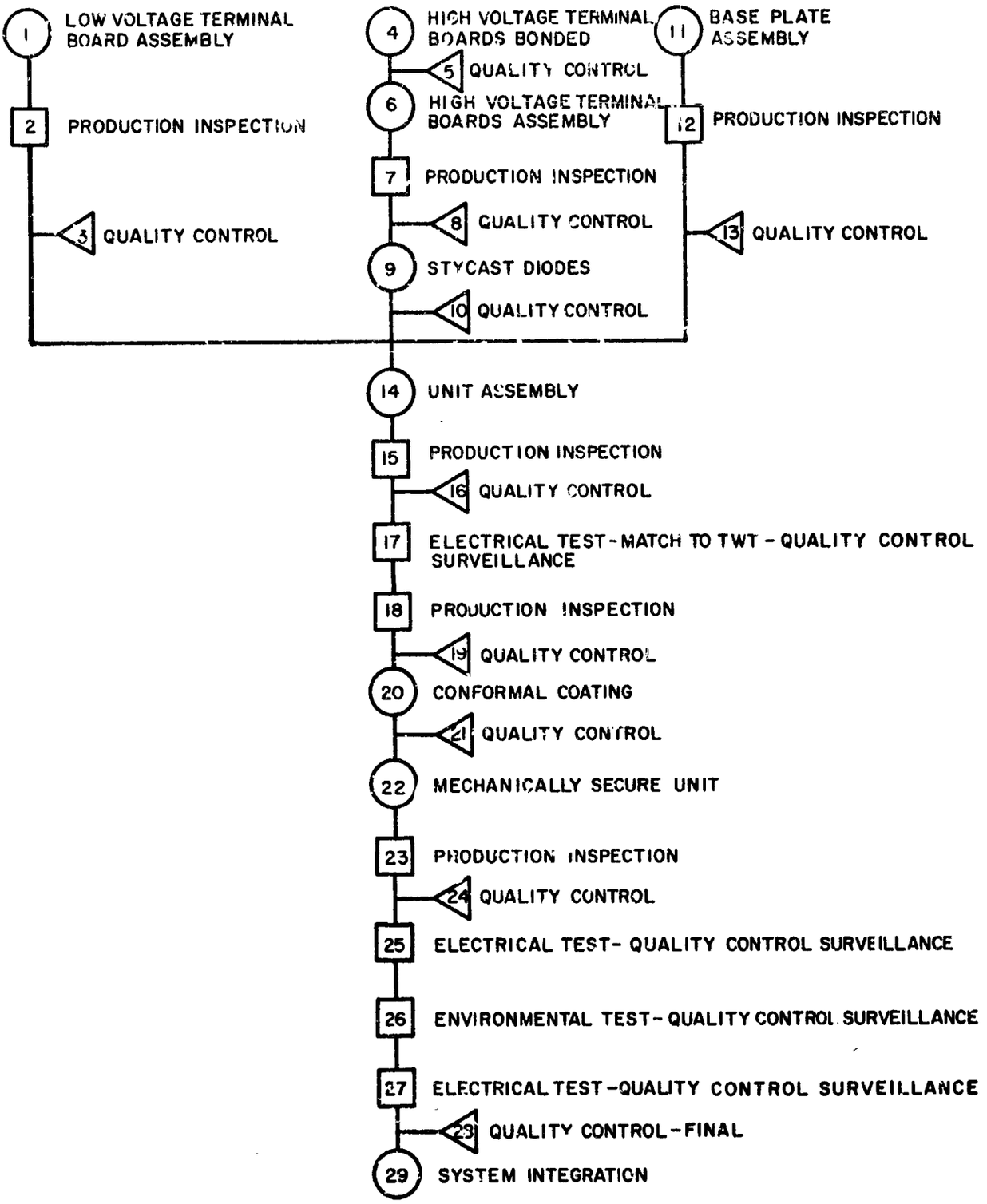

Figure III-11. TWT Power Supply In-Process Manufacturing Flow Chart

4) Station No. 4: The boards required for the high voltage terminal boards will be bonded together by chemistry laboratory personnel A traveler tag will be attached to the board.

5) Station No. 5: The quality control inspector will inspect the bonding of the two boards.

6) Station No. 6: Component parts will be assembled on the high voltage terminal board according to RCA Drawing No. 1707240. The components will be hand soldered.

7) Station No. 7: The production inspector will inspect all work performed on the board.

8) Station No. 8: The quality control inspector will survey the board.

9) Station No. 9: Chemistry laboratory personnel will use stycast to bond the diodes to the subassembly board.

10) Station No. 10: The quality control inspector will inspect the bonding.

11) Station No. 11: All component parts, mechanical brackets, and cabling will be assembled on the base plate according to RCA Drawing No. 1173764. A traveler tag for the base plate assembly will be attached.

12) Station No. 12: The production inspector will inspect the base plate assembly.

13) Station No. 13: The quality control inspector will inspect the base plate assembly.

14) Station No. 14: The subassemblies and other components of the unit will be assembled to the base plate assembly according to RCA Drawing No. 1173764. To facilitate inspection and conformal coating, the terminal boards will not be permanently secured to the base plate. A traveler tag will be attached to the unit.

15) Station No. 15: The production inspector will inspect the TWT power supply.

16) Station No. 16: The quality control inspector will inspect the unit.

17) Station No. 17: The TWT power supply unit will be matched to a TWT for proper transformer taps and resistance values in order that the unit meet specifications. A technician in the engineering area will perform any soldering or component mounting required for this operation.

18) Station No. 18: The production inspector will inspect those areas affected in the preceding station.

19) Station No. 19: The quality control inspector will inspect the areas affected by work performed at Station No. 17.

20) Station No. 20: The TWT power supply will be conformal coated in the engineering area.

21) Station No. 21: The quality control inspector will inspect the conformal coating.

22) Station No. 22: The TWT power supply will be permanently secured.

23) Station No. 23: The production inspector will inspect the completed permanently secured unit.

24) Station No. 24: The quality control inspector will inspect the completed unit.

25) Station No. 25: Engineering personnel will perform a functional electrical test under the surveillance of the quality control test monitor.

26) Station No. 26: The TWT power supply will undergo environmental tests under the surveillance of the quality control test monitor.

27) Station No. 27: Engineering personnel will perform a post-environmental functional electrical test under the surveillance of the quality control test monitor.

28) Station No. 28: The quality control inspector will inspect the completed unit after environmental test for all defects caused by the test and by the handling.

29) Station No. 29: The TWT power supply will be transported to the hold area to await system integration.

M. VOLTAGE REGULATOR PROCEDURE

Production inspection and quality control sections will inspect the voltage regulator, RCA Drawing No. 1179561, as outlined in the inspection instructions[3]. Subassemblies of the unit will be inspected and checked against their individual RCA drawings and specifications. Assembly, production, inspection, and quality control will be performed in accordance with the voltage regulator in-process manufacturing flow chart (see Figure III-12). Acceptance of a board or subunit by

[3] Ibid.

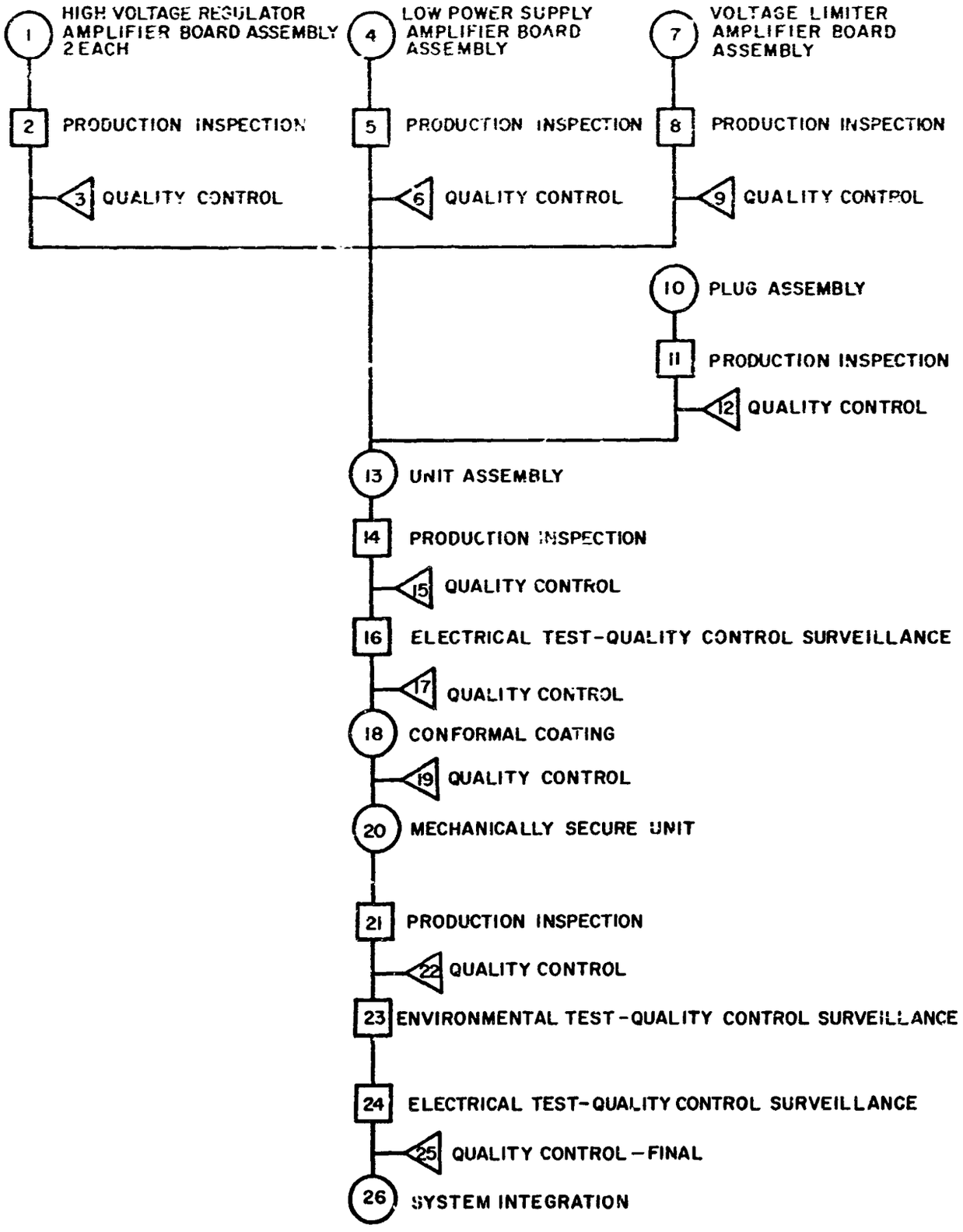

Figure III-12. Voltage Regulator In-Process Manufacturing Flow Chart

the production inspection or quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

The work performed at stations 1 through 3, 4 through 6, 7 through 9, and 10 through 12 may be performed as a parallel effort.

The work performed at each station of the flow chart is as follows:

1) Station No. 1: Component parts and point-to-point wiring will be hand soldered on the high voltage regulator amplifier boards according RCA Drawing No. 1178910. Two amplifier boards are required for each unit. Each board will have an individual serial number and will have its own traveler tag attached.

2) Station No. 2: The production inspector will inspect each of the high voltage regulator amplifier boards.

3) Station No. 3: The quality control inspector will inspect each board.

4) Station No. 4: Component parts and point-to-point wiring will be hand soldered on the low power supply amplifier board according to RCA Drawing No. 1179453. A traveler tag for the board will be attached.

5) Station No. 5: The production inspector will inspect the completed low power supply amplifier board.

6) Station No. 6: The quality control inspector will inspect the low power supply amplifier board.

7) Station No. 7: Component parts and point-to-point wiring will be hand soldered on the voltage limiter amplifier board according to RCA Drawing No. 1179540. A traveler tag for the board will be attached.

8) Station No. 8: The production inspector will inspect the completed voltage limiter amplifier board.

9) Station No. 9: The quality control inspector will inspect the voltage limiter amplifier board.

10) Station No. 10: The connector and the cable harness will be soldered together to make the plug assembly. A traveler tag will be attached to the plug assembly.

11) Station No. 11: The production inspector will inspect the plug assembly.

12) Station No. 12: The quality control inspector will inspect the plug assembly inspection.

13) Station No. 13: The two high voltage regulator amplifier boards, a low power supply amplifier board, a voltage limiter amplifier board, and the plug assembly will be assembled into a unit according to RCA Drawing No. 1179564. The unit will be temporarily mechanically secured. A traveler tag for the unit will be attached.

14) Station No. 14: The production inspector will inspect the assembled voltage regulator.

15) Station No. 15: The quality control inspector will inspect the voltage regulator.

16) Station No. 16: An electrical test of each board subassembly and of the completed unit assembly will be performed. The quality control test monitor will survey the tests.

17) Station No. 17: The quality control inspector will inspect the unit after the electrical tests.

18) Station No. 18: The unit will be conformal coated by chemistry laboratory personnel.

19) Station No. 19: The quality control inspector will inspect the conformal coating.

20) Station No. 20: The voltage regulator will be permanently mechanically secured.

21) Station No. 21: The production inspector will inspect the unit after it is mechanically secured.

22) Station No. 22: The quality control inspector will inspect the unit after it has been secured.

23) Station No. 23: The voltage regulator will undergo environmental testing under the surveillance of the quality control test monitor.

24) Station No. 24: Engineering personnel will perform a post-environmental electrical test on the voltage regulator. A quality control inspector will survey the test.

25) Station No. 25: The quality control inspector will inspect the completed unit after environmental testing for all defects caused by testing and by handling.

26) Station No. 26: The voltage regulator unit will be transported to a hold area to await system integration.

N. SPACECRAFT SYSTEM INTEGRATION PROCEDURE

Production inspection and quality control personnel will inspect all cable harnesses, structures, panels, and units of the spacecraft as outlined in inspection instructions[3]. Assembly, production, inspection, and quality control will be performed in accordance with the system integration in-process manufacturing flow chart (see Figure III-13). Acceptance of a cable harness, board, or subunit by the production inspection or quality control personnel shall be verified by a production inspection stamp or a quality control stamp. A stamp must appear on the appropriate traveler tag for every inspection and surveillance station indicated on the flow chart.

The work performed at each station of the flow chart is as follows:

1) Station No. 1: The cruciform will be assembled in accordance with RCA Drawing No. 1173705. A traveler tag for the cruciform will be attached.

2) Station No. 2: The production inspector will inspect the assembled cruciform.

3) Station No. 3: The quality control inspector will inspect the assembled cruciform.

4) Station No. 4: The units of block "A" of the system integration flow chart (see Figure III-13) will be attached to the cruciform structure. The units will be attached in the order they appear in the block; however, this is not finalized and is subject to change. A traveler tag for the cruciform structure with the units incorporated will be attached.

5) Station No. 5: The wires and the connectors making up the cable harness will be soldered together. A traveler tag for the cable harness will be attached.

6) Station No. 6: The production inspector will inspect the cable harness.

7) Station No. 7: The quality control inspector will inspect the cable harness.

8) Station No. 8: The cable harness will be assembled to the cruciform structure.

9) Station No. 9: The current controller will be attached to the cruciform structure.

[3] Ibid.

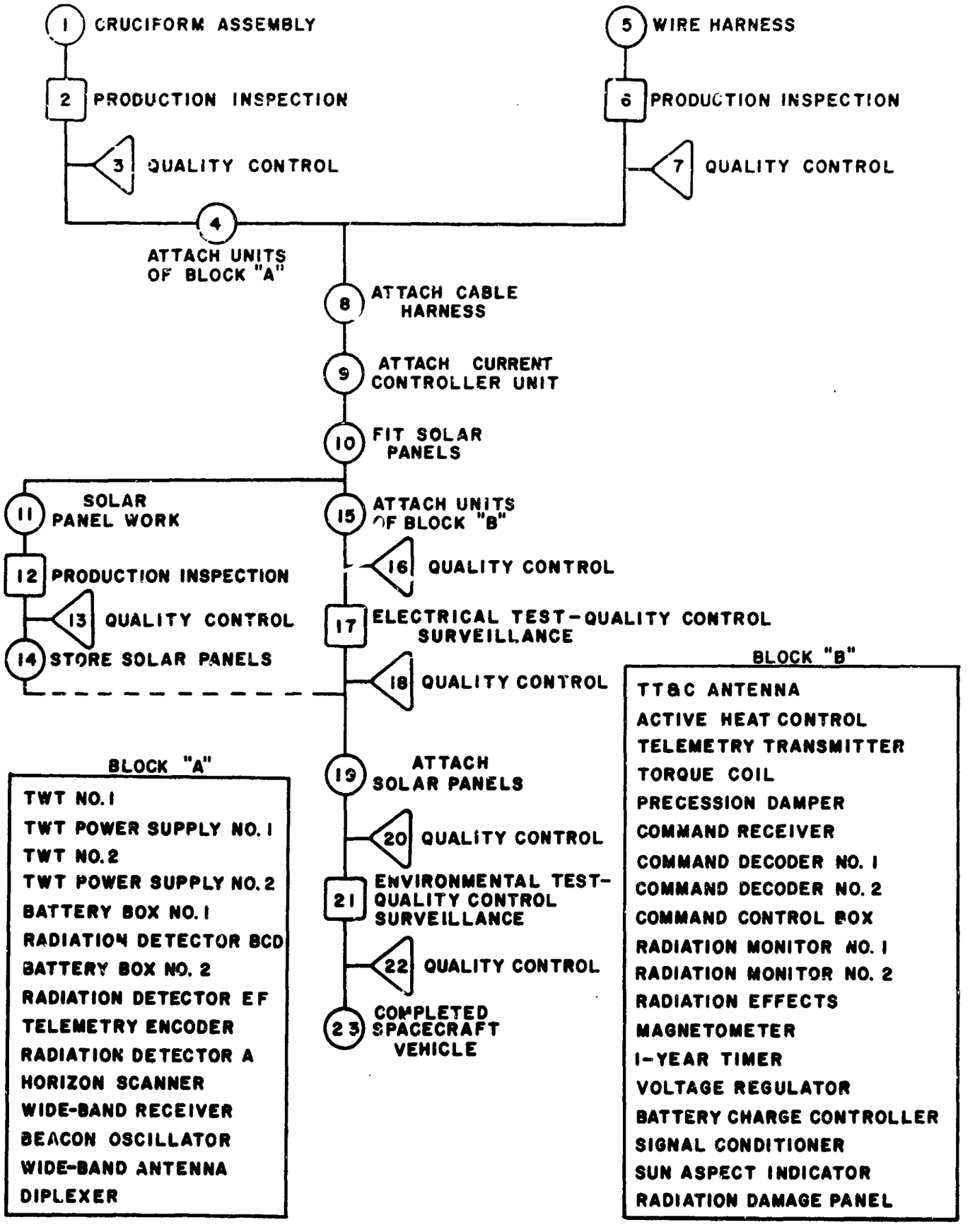

Figure III-13. System Integration In-Process Manufacturing Flow Chart

10) Station No. 10: The eight solar panels will be fitted to the cruciform structure.

11) Station No. 11: Personnel in the spacecraft integration assembly area will modify the solar panels, as required, for fitting to the cruciform structure and will add lock nuts to the solar panels.

12) Station No. 12: The production inspector will inspect all work performed on the solar panels, paying particular attention that the solar panels were not damaged in this process.

13) Station No. 13: The quality control inspector will inspect the solar panels.

14) Station No. 14: The solar panels will be stored in the integration area.

15) Station No. 15: The units of block "B" of the flow chart will be attached in the order they appear in the block; however, this is not finalized and is subject to change.

16) Station No. 16: The quality control inspector will inspect the cruciform structure, with the cable harness and the units of block "A" and block "B" attached.

17) Station No. 17: A complete electrical test will be accomplished on the spacecraft system. The quality control test monitor will survey this electrical test.

18) Station No. 18: The quality control inspector will make a complete visual inspection of the cruciform structure upon completion of the electrical test.

19) Station No. 19: The solar panels will be attached to the cruciform structure.

20) Station No. 20: The quality control inspector will inspect the spacecraft vehicle with the solar panels attached.

21) Station No. 21: The spacecraft vehicle will undergo environmental testing. The quality control test monitor will survey the environmental tests.

22) Station No. 22: The quality control inspector will inspect the spacecraft vehicle for any damage incurred either by the environmental tests or in transportation to and from the environmental test area. System integration personnel will assist the quality control inspector in removing or replacing any units or panels during the inspection.

23) Station No. 23: The spacecraft vehicle will be stored in such a manner that it will not be subject to damage while awaiting disposition.

SECTION IV

ENGINEERING LOG BOOK AND LOG BOOK FILE

A. INTRODUCTION

An engineering logbook will be maintained for each unit that is fabricated with an individual serial number. The log will be kept in a standard engineering type bound notebook. The log will contain a life history of the unit and its components from the units inception to its storage in the hold area. Detailed requirements for the log book are listed in paragraph B. A separate logbook for each spacecraft will include a list of individual units that are attached to the spacecraft.

When the final entry is made in a logbook the book will be deposited in a central file. The engineering logbook central file will be maintained by the quality control office. Detailed requirements for the file are listed in paragraph C.

B. ENGINEERING LOG BOOK REQUIREMENTS

1) Each serialized unit must have a log book.

2) The unit log book must accompany the unit through all phases of electrical and environmental testing.

3) All electrical test data must appear in the unit log book. The test data must include the following:

   a) The type of test and conditions.

   b) The signature of the personnel performing the tests.

   c) The signature of the quality control and/or product assurance personnel witnessing the test.

   d) The test equipment used, giving the type, manufacturer of equipment, model number, serial number, and dates of the last and next calibration (as applicable).

e) The applicable test specifications and test procedure or reference to the appropriate test specifications and/or test procedure. These will be included in the unit log book as an appendix or will be referenced therein.

f) The test data and any necessary interpretation.

g) Material to support the test results, such as photographs, curves, recording charts, graphs, plots, sketches, calculations, etc.

4) The environmental test data will include all the information listed for electrical test data in item 3 above. An additional requirement is that the Project Relay environmental test engineering leader must sign each set of test data.

5) A summary of test results, including a statement of successful completion of test and other pertinent details that would affect the test in any manner will be recorded in the unit log book.

6) All unit performance records (UPR's) for the unit, including the UPR's for boards or subunits, will be attached to the log book.

7) All subunit quality control traveler tags and forms will be attached to the unit log book.

8) Time of power to equipment in total hours, as well as cumulative operating time must be entered.

9) The unit log book will indicate all malfunctions or failures. A copy of the Malfunction Report will be attached to a page of the unit log book. In addition, any failure, trouble, relocation of any parts, change in size or dress of wires, design change, significant change in performance, unexplained phenomena, waveform anomalies, potentiometers or other adjustable components close to their limit of adjustment, etc., should be recorded when they occur with explanations and should be considered when describing the malfunction or failure.

10) The signature and date of entry should accompany all information which may have a bearing on the performance or reliability of the equipment. Entries must either be in sufficient detail to permit an understanding of the action entered or must reference the document in which this detail may be found. Entries should be made during each operation.

11) All rework, repair or replacement must be entered. Record the weight of the unit after rework, repair or replacement, and difference from the original unit weight, if any.

12) The original copy of the unit log book and appendixed test data for each unit shall be submitted with the unit for final quality control approval.

13) The unit log book shall be reviewed and approved by the quality control office. A signature of the quality control personnel reviewing the log book will appear on the front inside cover page. This will be verification of approval. The unit log book with quality control approval will then be filed in a central file containing all the unit log books for each spacecraft.

14) The unit, when approved, will be stamped in the "FINAL" block of the traveler tag by the quality control inspector and sent to the integration area.

15) When a unit has been released to the integration area for final assembly into the spacecraft structure and, at a later date, is removed from the integration area, it and its log book shall be approved by the quality control office before it can be resubmitted to the integration area.

16) Each spacecraft will have a log book.

17) All the requirements for the unit log book will apply to the spacecraft log book.

18) All test data and other pertinent information obtained for units attached to the spacecraft structure will be entered in the spacecraft log book.

19) Upon final acceptance of a spacecraft, the original copy of the spacecraft log book will be filed with the unit log books for that spacecraft.

C. REQUIREMENTS FOR AN ENGINEERING LOG BOOK CENTRAL FILE

1) The Unit and Spacecraft Engineering Log Book Central File will be maintained by the project quality control office.

2) After the quality control office has approved the log book, the original copy of the log book will be placed in the central file.

3) A locator card file will be kept by the quality control office of all log books in the central file.

4) The log books can be taken from the central file by signing them out on the locator card.

5) At the close of the project, all log books signed out must be returned to the central log book file.

APPENDIX A

WORKMANSHIP REQUIREMENTS

The Workmanship Requirements Specification, No. 1175909, is included below as an appendix to this document. It was developed specifically to be applied to the fabrication of Project Relay equipment by the Astro-Electronics Division of RCA. It is the responsibility of the RCA-AED manufacturing and quality control activities to see that these workmanship requirements are met.

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REVISIONS

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A		Approved for Initial Release	10 MAY '62	R.A. Smith

FIRST MADE FOR	
NEXT ASS'Y	USED ON
	RELAY

CONTRACT NO.
NAS 5-1272

COMMODITY CODE

DRAWN DATE
P. Rhodes May 9, 1962

CHECKED DATE
F.P. Hansemann 9 May '62

DESIGN ACTIVITY APPD. DATE
R.A. Smith 10 May '62

RADIO CORPORATION OF AMERICA
CAMDEN, N.J.
ASTRO-ELECTRONICS DIVISION, PRINCETON, N.J.

WORKMANSHIP REQUIREMENTS SPECIFICATION PROJECT RELAY

CODE IDENT NO.	SIZE	
49671	A	1175909

SCALE | WEIGHT | SHEET 1 of 10

RCA 565A RCA DIST

RADIO CORPORATION OF AMERICA ▼ CAMDEN, N.J.

1.0 Scope

This specification establishes the workmanship requirements for equipment manufactured for the Relay Spacecraft.

2.0 Applicable Documents

In addition to the standards listed in paragraph 3.2, the following documents, of the issue in effect on the date of invitation for bids, form a part of this specification to the extent specified herein.

RCA-AED

Astro-Electronics Products Quality Control Manual

3.0 Requirements

3.1 General

The requirements of the workmanship standards listed in paragraph 3.2 shall be complied with except as modified by paragraph 3.3. In addition, the requirements of paragraph 3.4 must be met. However, in the event of conflict with engineering specifications or drawings applicable to a specific part or assembly, the requirements of the engineering specification or drawing shall take precedence over the requirements of this specification.

3.2 Workmanship Standards

RCA Number	Title
8030501	Definitions
8030502	Variations on Dimensions - Alignment
8030504	Variations on Dimensions - Hole Spacing
8030505	Shearing and Cutting
8030506	Depth of Drilled Holes
8030507	Holes - Angularity
8030508	Straightness - Unmachined Surfaces
8030509	Flatness - Sheet Metal
8030510	Burrs - Sheet Metal Fabrication
8030511	Screw Lengths

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RCA Number	Title
8030512	Breaking of Sharp Corners and Edges
8030513	Bending and Forming
8030514	Riveting - Solid
8030515	Metal Layout
8030516	Notching and Punching
8030517	Shearing
8030518	Turned Parts
8030519	Milled Parts
8030521	Grinding
8030522	Thread Cutting
8030523	Casting and Molding - Inserts
8030524	Castings Impregnated
8030525	Gasketing - Radio Frequency Interference
8030527	Screws
8030528	Screw - Assemblies
8030529	Screw Orientation
8030531	Screws - Thread Cutting
8030533	Thread Engagement
8030535	Screw and Washer Applications
8030537	Screws - Flat Head
8030540	Nut Application
8030541	Clinch Stud - Installation
8030542	Clinch Nut - Installation
8030544	Insert - Threaded
8030546	Riveting - Semi-Tubular
8030547	Riveting - Blind
8030548	Weld Nut - Installation
8030549	Grounding Shielded Wire and Cable
8030550	Plated Through Holes (Printed Circuit)
8030551	General Requirements
8030553	Cleanliness
8030554	Staking - (Metal)
8030556	Retaining Rings
8030557	Handling of Electronic Parts and Equipments
8030558	Terminal Spacing

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RCA Number	Title
8030559	Welding - Fusion
8030560	Parts Spacing
8030561	Resistance Welding - Spot
8030562	Conformal Coating - Non-Selective
8030563	Conformal Coating - Selective
8030564	Brazing
8030567	Organic Finishes
8030568	Electroplating
8030569	Vacuum Impregnation
8030570	Chemical Finishes
8030575	Reference Designation Location
8030576	Orientation and Legibility
8030579	Mounting of Nameplates
8030587	Meters
8030589	Hook-Up Wire
8030590	Wire and Cable Bends
8030592	Wire Assembly and Routing
8030593	Cabling
8030595	Lacing
8030596	Cable Wrapping
8030598	Securing Leads - Wraps and Crimps
8030599	Solder Connections
8030605	Crimp Type Connections (Solderless)
8030607	Terminals - Crimp Type - Pre-Insulated
8030624	Grounding Shielded Wire and Cable - Crimp Type
8030627	Grounding Shielded Wire and Cable - Solder Type
8030630	Component Mounting - Axial Lead Type
8030631	Component Mounting - Stud Type
8030639	Terminal Studs - Installation of
8030645	Terminal Board Connections

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RCA Number	Title
8030647	Resistor - (Ceramic) Mounting
8030650	Insulators - (Ceramic) Mounting
8030663	Molding
113-180-211	Board Condition - Miniature and Microminiature
113-180-212	Circuitry Condition - Miniature and Microminiature
113-180-213	Tolerances - Miniature and Microminiature
113-180-214	Component Part Installation - Miniature and Microminiature
113-180-215	Soldering - Miniature and Microminiature
113-180-216	Finishes and Coatings - Miniature and Microminiature
113-180-221	Board Condition - Miniature
113-180-223	Registration Tolerance - Miniature
113-180-224	Component Part - Miniature Installation
113-180-225	Soldering - Miniature
113-180-231	Board Condition - Microminiature
113-180-233	Registration Tolerance - Miniature
113-180-234	Component Part Installation - Microminiature
113-180-235	Soldering - Microminiature

3.3 Exceptions to Workmanship Standards

The following paragraphs contain exceptions and modifications which apply to the Workmanship Standards specified in paragraph 3.2.

3.3.1 Workmanship Standard 8030598, "Securing Leads - Wraps and Crimps." - Component leads may be layed in slotted terminals and soldered in place without crimping. (Ref.: Item 1).

3.3.2 Workmanship Standard 8030627, "Grounding - Shielded Wire and Cable - Solder Type." - Vinyl plastic sleeving shall not be used as illustrated. All sleeving shall be made of Teflon.

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3.3.3 Workmanship Standard 8030630, "Component Mounting."

3.3.3.1 Axial-lead Type - Leads may be connected to the bottom of the terminal. (Ref. : Item 3).

3.3.3.2 Tantalum Capacitors - The first bend in the leads shall be a minimum of 0.060 inch from the tantalum lead weld joint. (Ref. : Item 3).

3.3.4 Workmanship Standard 113-180-212, "Circuitry Condition-Miniature and Microminiature." The wiring definition (photoetch process) requirements shall be modified as follows:

Under Item 1: add sub-item 2 "Peaks and spurs shall not reduce the path spacing to less than 0.015 inch (after soldering) or less than the minimum spacing specified by applicable drawing".

Item 2: In sub-item 1 and sub-item 3, the minimum conductor width shall be 0.015 inch or the minimum width specified by the applicable drawing.

3.3.5 Workmanship Standard 113-180-214, "Component Part Installation - Miniature and Microminiature" - The lead clinch requirements shall be modified as follows:

Item 1, sub-item 1, specifies 0.020 inch minimum spacing between clinched leads and adjacent conductors. This requirement shall be modified to permit spacing as close as 0.015 as long as there is no electrical interference.

3.3.6 Workmanship Standard 113-180-215, "Soldering - Miniature and Microminiature." - The bridging and overlap requirements shall be modified as follows:

Item 1, sub-item 2, specifies a spacing of 0.020 inch minimum. This requirement shall be modified to 0.015 inch.

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3.4 Supplementary Requirements

The following workmanship requirements supplement the requirements of paragraph 3.2 and 3.3.

3.4.1 Component Mounting

3.4.1.1 Axial-lead components - The leads of axial-lead components shall be dressed so that the component body is flush against the mounting board to facilitate attachment of the body with a flexible-type conformal coating or an epoxy adhesive as specified by the assembly drawing. However, one-quarter watt resistors may be mounted perpendicular to the mounting board if this method of mounting is specified by the assembly drawing. When perpendicular mounting is used, the mounting shall conform to Figure 1.

3.4.1.2 Straddle-Pack Mounting - Straddle-pack mounting shall conform to Workmanship Standard No. 113-180-214.

3.4.2 Preforming of Component Leads - All component leads that will be soldered to terminal boards shall be preformed before mounting in a manner that will minimize the stress on the junction between the lead and the component body when the terminal board flexes under vibration and shock forces. The lead slack shall be gradual "Z", "J", or "U" in shape and shall increase the lead length (total path) by at least one lead diameter. The slack bends shall be parallel or perpendicular with respect to the plane of the terminal board. Stress-relief bends shall be made in both leads of axial-lead components before any soldering operations. All bends in the leads shall have a radius of at least 1.5 times the lead diameter. Bends shall be made with forming pliers or fixtures. A slight flattening of the leads in the bends is permissible, but there shall be no nicks or any other tool marks that may reduce the strength of the lead.

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3.4.3 Interconnecting Leads and Cables - Interconnecting leads and cables shall not be run under components or be stressed against terminals or noninsulated component leads. When it is necessary to run one lead across another, both leads shall be insulated. Leads extending more than 0.75 inch from a terminal shall be attached to the terminal board with a conformal coating or epoxy adhesive. The bonding need not be continuous; long runs may be intermittantly bonded with spots of coating or adhesive at one-inch intervals.

3.4.4 Lead Connections to Terminals

3.4.4.1 Round Terminals - Wires and leads shall be wrapped around round terminals. The connections shall conform to Workmanship Standard 8030598.

3.4.4.2 Slotted Terminals - Wires and leads shall be connected to slotted terminals by one of the following methods:

(a) Lay the lead or wire in the slot and solder in place.

(b) Use wrap techniques conforming to Workmanship Standard 8030598.

3.4.4.3 Number of Connections per Terminal - A maximum of three connections to any one terminal is desirable, but as many as five may be made providing the top lead does not extend above the top of the terminal by more than one-third of its diameter and all parts are secured by a conformal coating.

3.4.4.4 General - Excess leadwire shall be trimmed by a sharp pair of side-cutting pliers before soldering. Sharp bends in leads shall be avoided. Stranded leads shall be twisted and tinned before attachment to terminals.

3.4.5 Insulation Sleeving - When insulation sleeving is required on component leads, the sleeving shall cover the lead so that no more than 0.06 inch of lead is exposed at the junction with the component body or the terminal connection.

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3.4.6 Cables - Individual leads of cables, or the entire cable, shall be attached to terminal boards between the terminal connections and the flexure point of the cable to avoid stressing solder joints by motion of the cable.

4.0 Quality Assurance Provisions

4.1 Waivers

A specification of this type is very broad in coverage and all combinations of design problems cannot be anticipated. When the requirements of this specification conflict with design or reliability objectives, a waiver should be requested by the cognizant design engineer. The request should be directed to the Project Relay Product Assurance Office as soon as possible and preferably during the design phase. Requests will be reviewed by the Project Relay Design Review Board which is composed of representatives of Quality Control, Engineering, and the Project Office.

4.2 Repairs

All repairs of workmanship defects shall be made in accordance with the requirements of the Standard Repair List of the Astro-Electronics Products Quality Control Manual.

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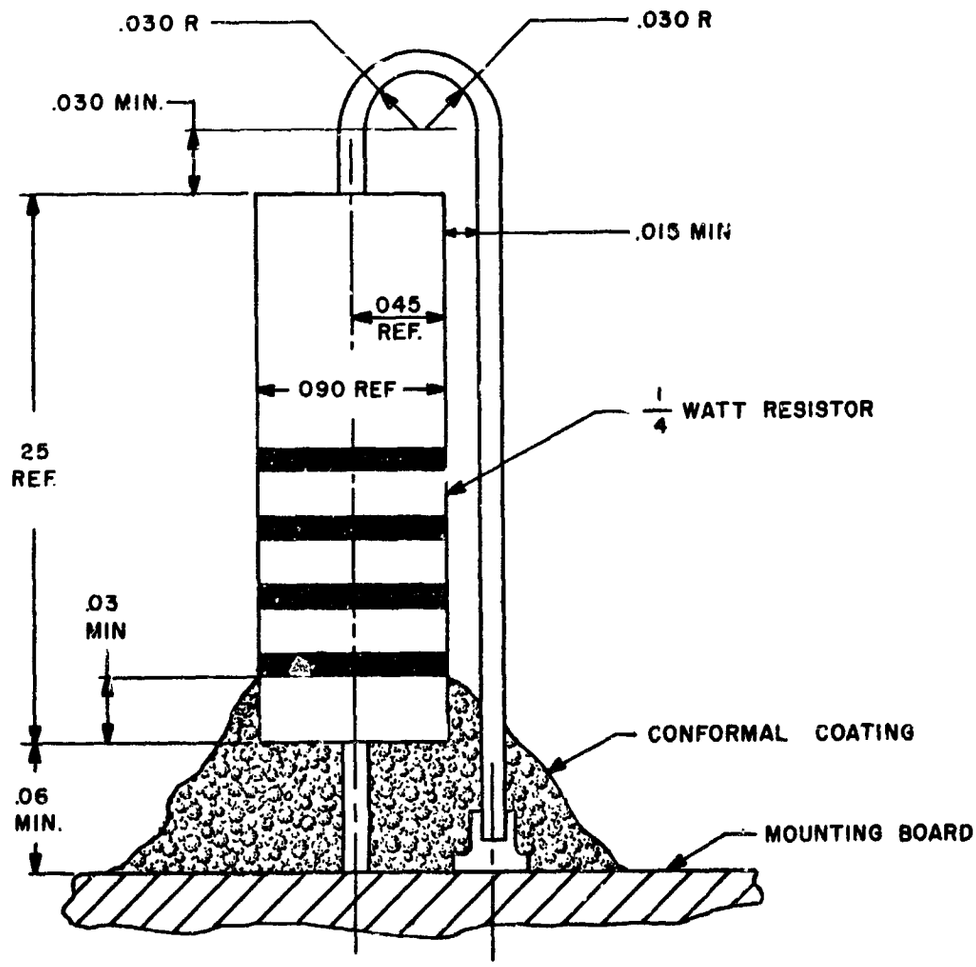

Figure 1. Perpendicular Mounting of 1/4 Watt Resistor

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